

The Milbank Memorial Fund  
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## IN THIS ISSUE

IN therapeutic, preventive, and war medicine the nurse occupies a position of importance that is second only to the doctor. The increased demand for nursing in the armed forces leaves fewer nurses available for civilian needs. The article "Frequency and Volume of Nursing Service in Relation to all Illnesses Among 9,000 Families," by Selwyn D. Collins, is of interest because it provides factual information on the civilian uses of nursing service in a non-wartime period. Such information is useful in estimating present civilian needs.

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The conventional method of constructing life tables is that of starting with 100,000 males and 100,000 females at birth and computing the number of survivors at successive ages on the basis of given schedules of age-specific mortality. In an article, "The Age-Sex Composition of the Population Resulting from Natality and Mortality Conditions," Dr. J. Yerushalmy of the Division of Research in the Children's Bureau departs from this convention by starting with an excess of males on the basis of the sex ratio at birth. His chief interest was to ascertain the sex composition at successive ages resulting from the joint influences of sex ratio at birth and sex differences in age-specific mortality. The resulting data serve two main purposes. If used judiciously, they afford a basis for judging the accuracy of actual age data in the census. The author compares the sex composition at successive ages in his life table with actual age-specific sex ratios derived from census material and discusses the possible bearing of several factors, including census inaccuracies, on certain marked discrepancies. The second major use demonstrated by the author is that of constructing a single life table for males and females combined, adjusted for sex.

The war has accelerated appreciation of mass radiology in the detection of tuberculous disease, for war means the assembling of large numbers of men in the armed forces, and the x-ray survey is the most effective method of screening out the symptomless case. In the article "The Cost of Tuberculosis Control in the Department of Health of New York City," Dr. H. R. Edwards gives a careful accounting of mass survey costs, and costs of other methods of case finding. Cost data are important for they provide a basis for planning a practical program for the control of tuberculosis.

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The present need for industrial manpower has focussed attention on the possibility of wider use of the physically handicapped in the battle of production. Government, industry, and labor are asking how the tuberculous worker can be utilized in the present industrial set-up. The article "The Sheltered Workshop in the Rehabilitation of the Tuberculous" by Dr. Louis E. Siltzbach is especially timely. From the experience of the Altro Work Shops over a period of twenty-five years, it is concluded that the successfully treated part-time and full-time tuberculous worker can be integrated into the manning of the war industries with benefit to the nation and to the worker himself.

# FREQUENCY AND VOLUME OF NURSING SERVICE IN RELATION TO ALL ILLNESSES AMONG 9,000 FAMILIES

BASED ON NATION-WIDE PERIODIC CANVASSES, 1928-1931<sup>1</sup>

SELWYN D. COLLINS<sup>2</sup>

IN therapeutic, preventive, and war medicine, the nurse forms a line of defense that is second only to the doctor. The prompt restoration of a patient to health often depends to a considerable extent upon the medical and nursing care which he receives, and prompt restoration to health means increased manpower.

The increased demand for nursing in the armed forces leaves fewer nurses available for civilian needs. Moreover, certain population trends complicate the nursing problem: (a) the long time trend toward an older population means an increasing need for nursing because older persons suffer more illnesses that require or at least receive nursing care (22), and (b) the recent sharp increase in the birth rate means additional nursing for mothers and infants.

It seems timely to present some quantitative data on the extent of nursing care. This study considers the amount and kind of nursing received for illness in a group of canvassed families, the diagnoses that were chiefly responsible for the nursing, the proportion of

<sup>1</sup>From General Morbidity Studies, Division of Public Health Methods, National Institute of Health.

This is the twentieth of a series of papers on sickness and medical care in this group of families (1-19). The survey of these families was organized and conducted by the Committee on the Costs of Medical Care; the tabulation was done under a cooperative arrangement between the Committee and the Public Health Service. Committee publications based on the results deal primarily with costs and Public Health Service publications primarily with the incidence of illness and the extent and kind of medical care, without regard to costs. As costs are meaningless without some knowledge of the extent and nature of the service received, there is inevitably some over-lapping. The Committee staff, particularly Dr. I. S. Falk and Miss Margaret Klem, cooperated in the tabulation of the data.

Special thanks are due to Dr. Mary Gover and Miss Clara E. Councell who assisted in the analysis, and to Mrs. Lily Vanzee Welch and Mrs. Dorothy Oliver who were in charge of tabulating the data.

<sup>2</sup>Principal Statistician, United States Public Health Service.

nursing cases and days that were hospital or home, surgical or non-surgical, and the variation in nursing care with age and sex.

#### SOURCE AND CHARACTER OF DATA

In the study of illness in a group of families in eighteen States<sup>\*</sup> that was made by the Committee on the Costs of Medical Care (20) and the United States Public Health Service, the record for each illness included a statement of the nursing days and visits received within the twelve-month study period.

The composition and characteristics of the group of 8,758 white families which were kept under observation for twelve consecutive months in the years 1928-1931 have been considered in some detail in the first report in the series (1). These families, including a total of 39,185 individuals, resided in 130 localities in eighteen States representing all geographic sections. Every size of community was included, from metropolitan districts to small industrial and agricultural towns and rural unincorporated areas<sup>4</sup>. With respect to income, the distribution was reasonably similar to the estimated distribution of the general population of the United States at the time of the survey.

Each family was visited at intervals of two to four months for a period long enough to obtain a sickness record for twelve consecutive months. On the first call a record was made of the number of members of the household, together with sex, age, marital status, and other facts about each person. On succeeding visits the canvasser recorded all illness that had occurred since the preceding call, with such pertinent facts about each case as the date of onset; total

<sup>\*</sup>The eighteen States sampled and the number of canvassed families were as follows: California (890), Colorado (386), Connecticut (100), District of Columbia (99), Georgia (544), Illinois (463), Indiana (494), Kansas (301), Massachusetts (287), Michigan (329), Minnesota (224), New York (1,710), Ohio (1,148), Tennessee (212), Virginia (412), Washington (551), West Virginia (318), Wisconsin (290). Further details about the distribution of the canvassed population are included in a preceding paper (1).

<sup>4</sup>Every community that was included in the study had either a local health department or some other organization employing a visiting nurse or both; therefore, the most rural areas with no organized community services are not represented.

duration of symptoms, of disability, of confinement to bed and to a hospital; whether attended by a doctor; and the nature and extent of nursing service received. Records for persons who were still sick at the preceding visit were brought up to date and when completed the termination of the case was entered. Thus there are available certain facts about the observed population, the number of illnesses suffered, and the frequency and volume of nursing services in connection with those illnesses.

*Definition of Illness and Nursing Care as Recorded in Survey.* An illness, for the purpose of this study, was defined as any symptom, disorder, or affection which persisted for one or more days or for which medical service<sup>\*</sup> was received or medicine purchased. Illness included the results of both disease and injury. What was actually included as illness, however, was necessarily influenced not only by the informant's conception of sickness but also by her memory. With visits as infrequent as two to four months, it was inevitable that many of the unattended nondisabling illnesses would be terminated and forgotten before the next visit of the enumerator.

Nursing service included all care of illness by graduate and practical nurses within or outside of a hospital, and also care by visiting nurses from all types of organizations such as health departments, industrial establishments, and insurance companies. It was assumed that special or private nursing in hospitals was all done by trained nurses, designated in this paper as graduate. The services of maids and other servants were not counted as nursing even when procured because of the illness<sup>\*</sup>.

A day of nursing care refers to the service of one nurse during a shift or period of nursing; thus a case with both a day and a night nurse would count as two days of nursing for each calendar day

<sup>\*</sup> Exclusive of dental services, eye refractions, immunizations, and health examinations rendered when no symptoms were present.

<sup>\*</sup> Hospital care and private nursing within the hospital were considered in a preceding paper (18). A later paper will consider nursing among families of different income levels and in urban and rural areas.

that such service was continued. On the other hand, if only one nurse was employed, the calendar day was counted as only one day of nursing even though the hours were exceptionally long. The data were not recorded so that exact hours could be counted.

*Classification of Causes of Illness.* The diagnosis as reported by the family informant was submitted to the attending physician for confirmation or correction and his diagnosis substituted for the one given by the family. While reports could not be obtained from all attending physicians, the replies indicated that the housewife usually reported with reasonable accuracy the diagnosis which the physician had given to the family<sup>7</sup>.

Considering an illness in the sense of a continuous period of sickness, only 4.3 per cent were designated as due to more than one cause. In general, the more important or more serious cause was assigned as primary, except where a disease like pneumonia is commonly recognized as following measles or influenza, in which case the antecedent condition was taken as primary<sup>8</sup>. In this paper some tables are based on sole or primary causes only and others include the contributory causes; each table indicates which procedure was followed.

*Methods of Tabulating and Computing.* In computing nursing cases per 1,000 population, illnesses that originated prior to but caused sickness during the study year are included along with cases having their onset within the period of observation; the inclusion of the illnesses with prior onset seemed necessary to give proper representation to chronic ailments. The only date of onset available was the onset of symptoms (nondisabling or disabling); therefore, prior onset does not necessarily mean that the nursing service began prior to the study year. Seven per cent of the attacks of illness had their onset prior to the year; this does not mean that in the other

<sup>7</sup> See comparison of diagnoses reported by families and by physicians in the Health Survey of 1935-1936 (23, Table 2).

<sup>8</sup> Further details on the method of classifying the causes of illness are included in the first report in the series (1).

93 per cent the disease always had its onset within the year, for the patient may have had preceding attacks of the same chronic disease.

Nursing days and visits refer in all instances to those *within the twelve-month study period*. In computing averages per case, both complete and incomplete cases are included as cases but the days and visits refer to those within the study year only. The incomplete cases (those with prior onset and those still sick at the last report) usually average considerably longer durations and presumably have more nursing care than the complete cases; therefore, average nursing days per case which excluded cases with prior onset would be biased toward fewer days and visits. Computation of the annual nursing days and visits per 1,000 persons includes all days and visits within the study year, whether the nursing pertains to cases that originated within or prior to the year and whether it pertains to cases that had been terminated or were still sick at the last report on the case<sup>9</sup>. Nursing cases with an unknown number of nursing days or visits are put in at the average per case of the same diagnosis.

#### EXTENT OF NURSING CARE AS MEASURED BY VARIOUS TYPES OF RATES

The extent of nursing care in a given population group may be measured by several different types of rates: (a) percentage of cases that had nursing care of any kind, (b) cases attended by a nurse per 1,000 population, and (c) nursing days or visits per 1,000 population. All of these rates may be subdivided by considering separately (1) full-time care by a private duty nurse, (2) part-time care by a general duty nurse in a hospital, and (3) care by a nurse who visits the home one or more times during the illness. Aside from this classification, private duty nursing may be divided into (a) that given by a graduate or trained nurse, and (b) that given by a practical nurse.

<sup>9</sup> A preceding paper (15) shows the percentage of cases of different types that were incomplete because of prior onset or because still sick at the last report on the case.

*Summary of Nursing Care for Illness at All Ages*<sup>30</sup>. Of the total of 32,752 illnesses reported in the periodic canvasses of this study, 11.2 per cent had some nursing care of one type or another. Of these cases with some nursing, approximately half (5.7 per cent of all cases) were hospital cases without a private nurse but with the usual care of the general duty nurses for the ward or floor or wing in which they were located. Another 2.1 per cent had the full-time services of a private duty graduate nurse either in or outside of the hospital, and an additional 0.7 per cent had the full-time services of a practical nurse for one or more days or nights. The other 2.7 per cent had the services of a visiting nurse but no full-time nurse. Since some patients had the services of more than one type of nurse, the above percentages do not all represent the total cases for specific kinds of nurses. Of all cases, 2.07 per cent had a graduate nurse, 0.82 per cent had a practical nurse, and 3.70 per cent had a visiting nurse. Of the total cases, 2.77 per cent had the exclusive services for one or more days or nights of a private nurse (graduate or practical) either in or outside of a hospital, and 0.56 per cent had the exclusive services of two or more such nurses during one or more twenty-four-hour days.

Inquiry was also made as to whether any help other than that of a nurse was secured because of the particular illness. Of all illnesses, other help was secured for 1.20 per cent; in about half of these cases there was a nurse as well as other help, but in 0.59 per cent help other than a nurse was the only service secured because of the illness.

The total cases during the year with a full-time private nurse of

<sup>30</sup>In the following summary and throughout this paper nursing case and day rates per 1,000 for all causes and for all except female genital and puerperal causes are adjusted to the age distribution of the white population of the United States in 1930. Because of the high rates in old age and the under-representation of old people in the canvassed population, the adjusted rates are considerably higher than the crude. No adjustments for age differences have been made in any rates for specific diseases.

Percentages of cases and nursing days per case are based on actual cases and days with no adjustment for age. In some preceding papers "adjusted" percentages were com-

(Continued on page 11)

any kind amounted to 26.6 per 1,000 population. The corresponding rates for graduate and practical nurses were 19.4 and 8.6 per 1,000, respectively, some cases having both kinds of nurses. The volume of private nursing care amounted to 437 days per 1,000 population, 248 for graduate and 189 for practical nursing<sup>21</sup>. The

puted by relating two adjusted rates instead of using numbers of cases, and "adjusted" days per case by relating adjusted rates for days and cases. Both types of measures are included in Table 1.

Rates and averages involving days of nursing are exclusive of eight exceptionally long cases; for details see footnote 11.

<sup>21</sup> The line between a practical nurse and an attendant or companion becomes vague when the illness is of long duration and the patient is not acutely sick. In this study there were eight illnesses with so much nursing (equivalent of eight months or more of the study year) as to raise doubt as to whether all of the service should be classified as nursing. These eight cases (0.9 per cent of the 907 nursing cases) had 2,541 days of nursing (16.0 per cent of the 15,898 nursing days). Each of the eight long cases had a practical nurse with an aggregate of 1,708 days (shifts); five of the eight cases also had a graduate nurse with an aggregate of 833 days (shifts). Only one of the three hospital cases had a nurse while in the hospital, with twelve days (shifts). All eight cases were nonsurgical.

In view of the long nursing duration of these few cases and their undue influence upon day rates and averages these eight cases were excluded from computations of nursing days per 1,000 population and nursing days per case. Nursing days (shifts) per 1,000, including the eight long cases were: all private duty, "adjusted" 544, crude 412; graduate "adjusted" 274, crude 236; practical "adjusted" 270, crude 176 days per 1,000. Nursing days (shifts) per case including the eight long cases were: all private duty "adjusted" 20.5, crude 17.5; graduate "adjusted" 14.1, crude 13.4; practical "adjusted" 31.5, crude 25.0 days per case. Per cent of nursing days (shifts) that were rendered in a hospital, including the eight long cases were: all private duty "adjusted" 29, crude 33; graduate "adjusted" 58, crude 58.

No exclusions were made for cases in institutions for the resident care of tuberculosis, mental, and other chronic diseases because very little private duty nursing was reported among these patients.

The eight cases with 252 or more days (shifts) of nursing care were: (1) Mental case with no days in bed but with a practical nurse 335 days of the study year. Not in hospital. (2) Heart and high blood pressure, in bed 119 days of the study year with a graduate nurse for seventy-four days and a practical nurse for 315 days. Treatment was at a clinic and at home; not in hospital. (3) Tuberculosis of spine, in bed 252 days of the study year and had a practical nurse throughout the year. Treated at clinic; not in hospital. (4) Paralytic, in bed throughout year with practical nurse the whole year; not in hospital. (5) Cancer, in bed fifty-seven days with two day and two night graduate nurses, one practical nurse and another attendant for fifty to fifty-seven days (shifts) each, and all within a period of fifty-seven calendar days; not in hospital. The record indicated so much nursing as to suggest that some was attendance other than nursing. (6) Accident, twenty days in bed; twelve days in hospital and in four of those days had two day and one night nurses, or twelve shifts. After leaving hospital had a graduate nurse for fourteen days and a practical nurse for 210 days. (7) and (8) Premature twins born in a hospital (maternity home) and stayed there with mother for twenty-one days but had no private nurse. After left hospital older children in family had whooping cough so premature twins were sent to the home of a graduate nurse and stayed for 252 days. One infant died but other had a graduate nurse for fourteen days and a practical nurse for fifty-six days in own home.

Of the five cases with from six to eight months of nursing (180 to 222 shifts) two were hospital cases and had a graduate nurse but one had only two days of such nursing. None of these were excluded from the rates.

average nursing care by a private nurse in or outside of a hospital amounted to 14.9 days (shifts) per case, 12.3 for graduate and 19.3 for practical nurses.<sup>13</sup> The average nursing care in a hospital amounted to 11.0 days (shifts) per hospital case with a private nurse, presumably graduate in all or practically all instances.

Of the illnesses which confined the patient to bed for one or more days, 5.4 per cent had a full-time private nurse. Of the hospital cases (exclusive of those in institutions for tuberculosis and mental and other chronic diseases), 20 per cent had a private nurse for one or more days or nights while in the hospital, and of the total days in the same types of hospitals, 15 per cent were days with a private nurse for one or more of the two or three nursing shifts of the twenty-four-hour hospital day. Of the total cases with a private nurse, 52 per cent had such a nurse while in a hospital; of the total days and nights (shifts) of private nursing, 39 per cent were rendered in hospitals, the other 61 per cent being home nursing. Of all cases with a graduate private nurse, 70 per cent had such a nurse while in a hospital, and of all graduate nursing days and nights (shifts), 63 per cent were rendered in hospitals. The latter statements assume that all *private* nursing in hospitals was done by trained or graduate nurses.

Cases which had the services of a visiting nurse amounted to 30.8 per 1,000 population with a total of 230 nursing visits per 1,000 population; thus there were 7.5 nursing visits per case receiving such service. Of the total illnesses, 3.7 per cent had one or more visits by a nurse.

*Age and Sex Variation in the Several Types of Rates.* Figure 1 shows the variation with age and sex in full-time private duty nurs-

<sup>13</sup> The above averages consider days of one type of nursing regardless of days of the other type on the same case. The following averages consider all nursing days together: cases attended by one graduate nurse averaged 9.2 days (shifts) per case, as compared with 18.6 for those attended by one or more practical nurses; cases with two or more graduate nurses averaged 23.8 days (shifts) per case as compared with 28.7 for those with one graduate and one or more practical nurses. Cases with more than one practical nurse and more than two graduate nurses were negligible in number. These averages are exclusive of the eight cases with 252 or more days of nursing on each.

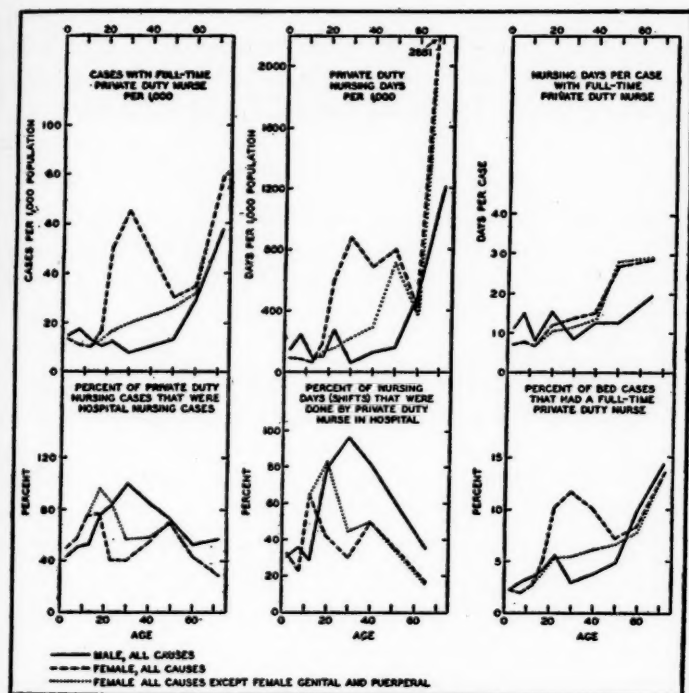


Fig. 1. Annual volume of private duty nursing among males and females of specific ages for illness from all causes as measured by various types of rates—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Scales are so made that the adjusted rate for all ages of both sexes represents an interval on the vertical rate scale that corresponds to 30 years on the horizontal age scale.)

ing by any type of nurse and Figure 2 shows similar data for full-time graduate and practical nurses and for visiting nurses. Table 1 shows these and other data by age and sex. Because puerperal and female genital diagnoses receive considerable nursing care, the rates for females are shown for all causes and for all except those diagnoses. The male genital cases are not frequent and would not materially change the curves for all causes of illness. Figure 2 compares for specific ages actual rates for the three types of nursing.

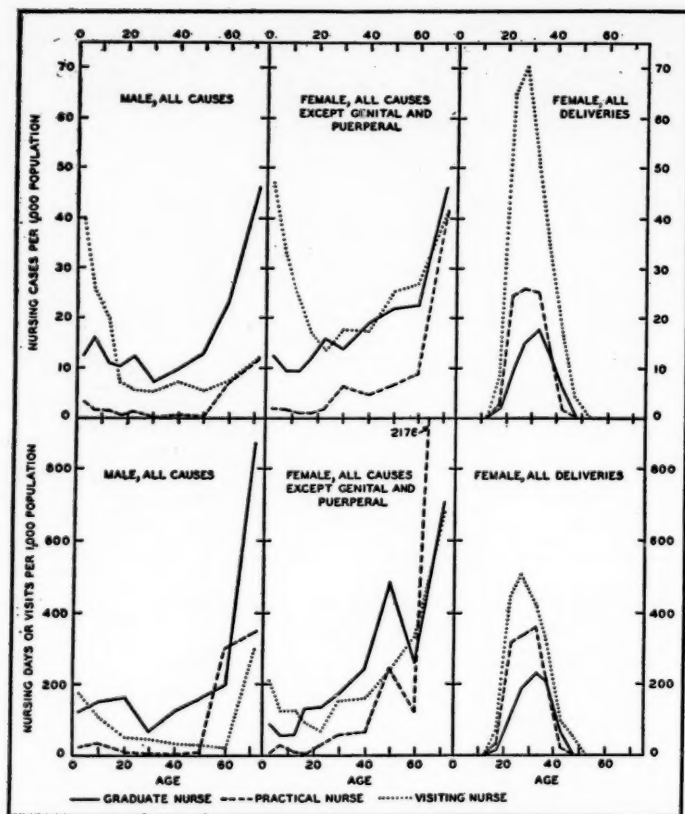


Fig. 2. Graduate, practical, and visiting nursing among males and females of specific ages for illness from all causes and from deliveries—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931.

Although sickness rates per 1,000 are higher for children than adults, private duty nursing case and day rates are little if any higher for children. This is true of both graduate and practical nursing but visiting nursing rates are relatively high for young children (Fig. 2). Aside from the large peak of nursing for puerperal cases, private duty nursing rates for females show a rather con-

tinuous rise after 15 to 20 years, but those for men remain rather low until 40 to 50 years, due largely to the extremely low rate for practical nursing for males under 55 years of age. In the older ages both sexes show large increases, particularly practical nursing among women.

The most striking difference between the sexes is the very large peak of nursing in the childbearing ages. (Fig. 1.) Although actual peak rates from all causes are higher for graduate nursing, relative to rates for other ages the peak is much higher for practical nursing, particularly for younger women. Practical nursing is rather largely confined to women of the childbearing and old ages.

For diagnoses common to the two sexes adult women also had rather consistently more nursing cases and days than men. For all ages the rates for all private duty nursing for men were 15.7 cases per 1,000 as compared with rates for women of 35.8 for all causes and 21.6 for all except female genital and puerperal diagnoses<sup>28</sup>. All nursing days per 1,000 were 236 for men as compared with rates for women of 610 for all causes and 399 for all except female genital and puerperal. In connection with the higher nursing rates for adult women it should be remembered that illness of the housewife often leaves no one to care for the patient, but the housewife is available for home nursing of adult males and children.

For diagnoses common to the two sexes, the practical nursing case rate for females was 2.7 times that for males, as compared with 1.2 for graduate cases. In practical nursing days per 1,000 the rate for females was 3.5 times that for males, as compared with 1.2 for graduate days.

For males of all ages, 13 per cent of the private duty nursing cases had practical nurses, as compared with percentages for females of 37 for all causes and 24 per cent for diagnoses common to the two sexes. The percentage of private duty nursing days that were ren-

<sup>28</sup> Throughout this paper, benign tumors of the female genital organs and breast and other diseases of the female breast are included in the group of female genital diseases.

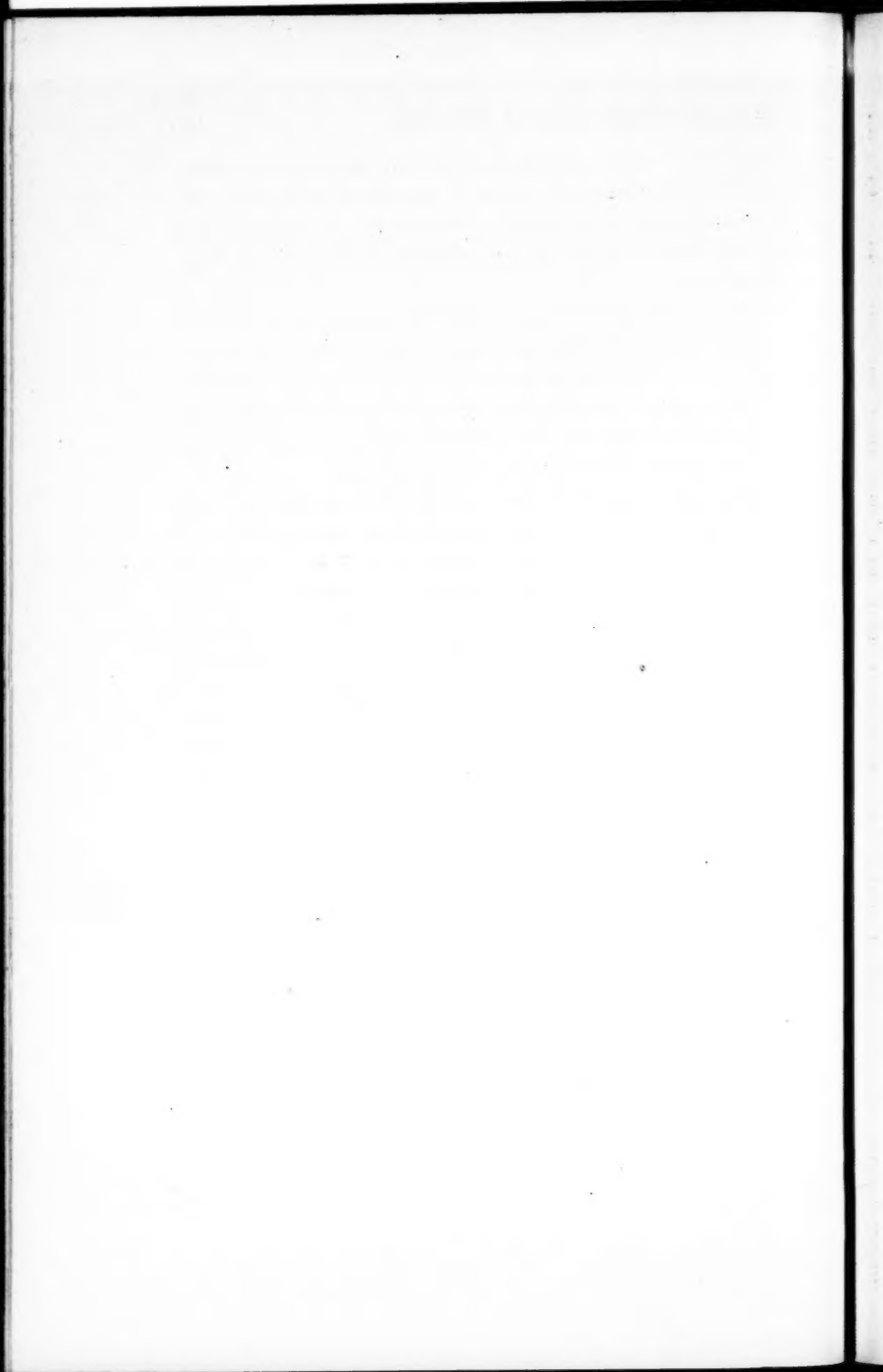


Table 1. Frequency and volume of nursing service in connection with illness among persons of specific ages for each sex—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931.

SEX AND TYPE OF RATE	ALL AGES <sup>1</sup>		AGE <sup>2</sup>										
	Number of Cases, Days, or Visits	Ad-justed <sup>3</sup>	Crude	Under 5	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55-64	65 and Over
<b>FULL-TIME PRIVATE DUTY NURSE OR ANY KIND</b>													
<i>Private Nursing Cases<sup>4</sup> Per 1,000 Population</i>													
Both Sexes, All Causes	907	26.6	23.5	13.8	14.0	11.4	13.4	34.0	40.3	28.5	20.6	31.2	69.1
Male, All Causes	266	14.1	14.3	17.0	17.0	12.6	10.5	12.3	7.9	10.4	13.0	28.6	57.2
Female, All Causes	640	35.8	32.6	13.0	11.1	10.1	16.4	49.8	64.2	46.8	29.9	34.4	78.4
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	368	21.6	18.7	13.0	11.1	10.1	12.5	16.3	19.5	22.7	25.9	31.4	78.4
<i>Nursing Days<sup>6</sup> (Shifts) Per 1,000 Population</i>													
Both Sexes, All Causes	13,357	437	347	126	158	85	143	464	536	414	450	467	2,151
Male, All Causes	3,566	189	150	104	122	62	102	282	271	132	164	499	1,215
Female, All Causes	9,791	610	498	192	86	68	183	598	884	608	801	420	2,881
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	5,766	399	301	92	86	68	135	160	235	302	744	384	2,881
<i>Per Cent of Total Cases<sup>4</sup> That Had a Private Nurse</i>													
Both Sexes, All Causes	32,752	3.2	2.8	1.1	1.4	1.7	2.2	5.1	4.9	3.7	2.7	3.7	7.1
Male, All Causes	14,596	2.2	1.8	1.1	1.7	1.8	1.9	2.7	1.3	1.7	2.1	4.0	6.7
Female, All Causes	18,156	3.9	3.5	1.1	1.2	1.5	2.6	6.0	6.6	5.0	3.2	3.5	7.3
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	16,606	2.6	2.2	1.1	1.2	1.5	2.1	2.6	2.6	2.8	2.9	3.2	7.3
<i>Per Cent of Disabling Cases<sup>4</sup> That Had a Private Nurse</i>													
Both Sexes, All Causes	19,887	5.4	4.6	2.1	1.9	2.4	3.6	7.9	8.2	6.7	5.2	7.3	12.6
Male, All Causes	8,927	3.6	3.0	2.1	2.3	2.6	3.1	4.2	2.2	2.9	3.8	7.4	12.0
Female, All Causes	10,961	6.6	5.8	2.0	1.5	2.1	4.0	9.4	11.0	9.3	6.6	7.3	12.9
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	9,710	4.6	3.8	2.0	1.5	2.1	3.3	4.7	4.9	5.6	6.1	6.8	13.1
<i>Per Cent of Bed Cases<sup>4</sup> That Had a Private Nurse</i>													
Both Sexes, All Causes	16,728	6.4	5.4	2.3	2.5	3.1	4.7	9.1	9.3	7.7	6.2	9.1	13.9
Male, All Causes	7,160	4.6	3.7	2.3	3.0	3.5	4.2	5.6	2.8	3.8	4.8	9.9	14.4
Female, All Causes	9,568	7.5	6.7	2.2	2.0	2.7	5.0	10.3	11.8	10.1	7.2	8.5	13.7
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	8,342	5.3	4.4	2.2	2.0	2.7	4.2	5.3	5.5	6.2	6.7	7.9	13.8
<i>Per Cent of Private Nursing Cases<sup>4</sup> That Were Hospital<sup>7</sup> Nursing Cases</i>													
Both Sexes, All Causes	475	51.1	52.4	46.1	52.5	61.5	75.6	45.8	44.5	58.6	71.0	47.8	39.1
Male, All Causes	165	63.7	62.0	44.5	50.0	51.7	75.0	81.8	100.0	83.9	70.8	52.2	56.0
Female, All Causes	309	47.1	48.3	48.6	56.3	73.9	76.0	39.3	39.4	52.9	71.1	43.5	29.5
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	212	55.2	57.6	48.6	56.3	73.9	94.7	85.0	55.6	56.7	69.2	42.9	29.5
<i>Per Cent of Nursing Days<sup>6</sup> (Shifts) That Were Hospital<sup>7</sup> Nursing Days</i>													
Both Sexes, All Causes	5,227	36.3	39.1	34.2	33.2	43.7	78.0	42.7	34.3	55.1	43.3	41.3	18.4
Male, All Causes	1,807	59.7	50.7	31.5	36.5	29.5	86.8	75.8	96.9	83.2	64.6	39.4	39.2
Female, All Causes	3,397	32.3	34.8	32.7	23.7	65.2	97.6	69.9	45.1	50.8	36.5	49.4	11.6
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	2,089	32.5	36.6	32.7	23.7	65.2	97.6	69.9	45.1	50.8	36.5	49.4	11.6
<i>Nursing Days (Shifts) Per Case With Private Nurse<sup>8</sup></i>													
Both Sexes, All Causes	899	16.6	14.9	9.4	12.0	7.5	10.7	13.7	13.3	14.6	21.9	15.6	32.5
Male, All Causes	262	15.2	13.6	11.1	14.8	8.1	9.9	22.9	8.5	12.7	12.6	19.1	21.2
Female, All Causes	636	17.2	15.4	7.1	7.8	6.7	11.1	12.0	13.8	15.0	26.8	12.5	39.4
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	364	18.8	15.7	7.1	7.8	6.7	10.8	9.8	11.5	13.5	28.0	12.2	39.4
<b>GRADUATE PRIVATE DUTY NURSE</b>													
<i>Graduate Nursing Cases<sup>4</sup> Per 1,000 Population</i>													
Both Sexes, All Causes	678	19.4	17.6	12.5	12.8	10.3	12.1	20.3	23.0	22.1	18.5	24.4	46.1
Male, All Causes	242	14.1	12.8	12.5	16.0	10.9	10.5	12.3	7.5	9.7	13.0	23.6	45.8
Female, All Causes	435	24.0	22.2	12.3	9.7	9.7	13.8	26.1	34.6	34.6	25.2	25.4	46.3
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	297	16.9	15.1	12.3	9.7	9.7	11.8	15.5	13.6	19.0	21.9	22.4	46.3
<i>Graduate Nursing Days<sup>6</sup> (Shifts) Per 1,000 Population</i>													
Both Sexes, All Causes	8,269	248	215	111	132	75	125	263	273	310	323	248	778
Male, All Causes	2,906	183	154	127	207	88	102	266	65	130	154	199	872
Female, All Causes	5,340	311	272	86	59	61	148	261	427	492	599	306	704
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	3,474	215	177	86	59	61	132	139	167	239	485	262	704
<b>PRACTICAL PRIVATE DUTY NURSE</b>													
<i>Practical Nursing Cases<sup>4</sup> Per 1,000 Population</i>													
Both Sexes, All Causes	272	8.58	7.06	2.36	1.57	1.31	1.97	15.57	18.62	7.59	3.88	8.15	28.06
Male, All Causes	35	2.21	1.85	3.21	1.77	1.74	.65	1.12	.42	.67	.54	7.46	11.44
Female, All Causes	237	13.78	12.08	1.49	1.38	.88	3.28	26.12	32.12	14.57	7.97	7.07	41.00
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	88	5.91	4.48	1.49	1.38	.88	.66	1.63	6.18	4.74	6.04	8.97	41.00
<i>Practical Nursing Days<sup>6</sup> (Shifts) Per 1,000 Population</i>													
Both Sexes, All Causes	5,088	189	132	15	36	11	18	201	263	103	127	219	1,374
Male, All Causes	660	53	35	23	45	13	2	16	3	2	10	300	343
Female, All Causes	4,428	299	226	7	27	7	35	336	456	206	272	123	2,176
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	2,232	184	114	7	27	7	3	31	57	64	239	123	2,176
<b>VISITING NURSE OR ANY KIND</b>													
<i>Visiting Nursing Cases<sup>4</sup> Per 1,000 Population</i>													
Both Sexes, All Causes	1,213	30.8	31.5	43.5	30.1	21.7	16.4	48.6	48.9	27.8	16.1	17.0	28.1
Male, All Causes	302	12.9	16.0	39.5	26.2	19.6	7.2	5.6	5.4	7.4	5.4	7.5	11.4
Female, All Causes	910	46.2	46.4	47.7	33.9	23.8	25.6	80.0	81.2	48.5	29.2	28.4	41.0
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per 1,000 Population	510	25.0	26.0	46.9	33.9	23.8	17.1	13.9	17.6	17.6	25.2	26.9	41.0
<i>Nursing Visits<sup>6</sup> Per Case With Visiting Nurse<sup>8</sup></i>													
Both Sexes, All Causes	8,155	230	212	192	117	124	98	333	391	237	144	168	510
Male, All Causes	1,619	83	86	175	102	121	33	85	48	34	34	26	295
Female, All Causes	6,535	359	333	211	131	127	164	513	645	443	279	338	677
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per Case With Visiting Nurse <sup>8</sup>	3,366	193	171	207	131	127	96	68	155	155	232	333	677
<i>Per Cent of Total Cases<sup>4</sup> That Had Visiting Nurse</i>													
Both Sexes, All Causes	1,213	7.5	6.7	4.4	3.9	5.7	6.0	6.8	8.0	8.5	8.9	9.9	18.2
Male, All Causes	302	6.4	5.4	4.4	3.9	6.2	4.5	15.2	8.9	4.6	6.2	3.5	25.8
Female, All Causes	910	7.8	7.2	4.4	3.9	6.4	6.4	7.9	9.1	9.1	9.5	11.9	16.5
Female, All Except Genital and Puerperal Nursing Visits <sup>5</sup> Per Case With Visiting Nurse <sup>8</sup>	510	7.7	6.6	4.4	3.9	5.3	5.0	4.9	8.8	8.8	9.2	12.4	16.5
<i>Per Cent of Total Cases<sup>4</sup> That Had Visiting Nurse</i>													
Both Sexes, All Causes	32,752	3.7	3.7	3.6	3.1	3.2	2.7	7.2	6.0	3.6	2.1	2.0	2.9
Male, All Causes	14,596	1.8	2.1	3.2	2.6	2.9	1.3	1.2	.9	1.2	.9	1.0	1.3

# *Nursing Days (Shifts)*

Both Sexes, All Causes	5,227	36.3	39.1	34.2	33.2	43.7	78.0	42.7	34.3	55.1	43.3	41.3	18.4
Male, All Causes	1,807	50.7	50.7	31.5	36.5	50.5	86.8	75.8	90.9	83.2	64.6	39.4	39.2
Female, All Causes	3,397	32.3	34.8	32.7	23.7	65.2	73.0	31.3	30.7	40.7	53.7	11.6	11.6
Female, All Except Genital and Puerperal	2,089	32.5	36.6	32.7	23.7	65.2	97.6	69.9	45.1	50.8	36.5	49.4	11.6

# *Nursing Days (Shifts) Per Case With Private Nurse<sup>1</sup>*

Both Sexes, All Causes	899	16.6	14.9	9.4	12.0	7.5	10.7	13.7	13.3	14.6	21.9	15.6	32.5
Male, All Causes	262	15.2	13.6	11.1	14.8	8.1	9.9	22.9	8.5	12.7	12.6	10.1	21.2
Female, All Causes	636	17.2	15.4	7.1	7.8	6.7	11.1	12.0	13.8	15.0	26.8	12.5	30.4
Female, All Except Genital and Puerperal	364	18.8	15.7	7.1	7.8	6.7	10.8	9.8	11.5	13.5	28.0	12.2	39.4

# *GRADUATE PRIVATE DUTY NURSE*

## *Graduate Nursing Cases<sup>2</sup> Per 1,000 Population*

Both Sexes, All Causes	678	19.4	17.6	12.5	12.8	10.3	12.1	20.3	23.0	22.1	18.5	24.4	46.1
Male, All Causes	242	14.1	12.8	12.5	16.0	10.9	10.5	12.3	7.5	9.7	13.0	23.6	45.8
Female, All Causes	435	24.0	22.2	12.3	9.7	9.7	13.8	26.1	34.6	34.6	25.2	25.4	46.3
Female, All Except Genital and Puerperal	297	16.9	15.1	12.3	9.7	9.7	11.8	15.5	13.6	19.0	21.9	22.4	46.3

## *Graduate Nursing Days<sup>3</sup> (Shifts) Per 1,000 Population*

Both Sexes, All Causes	8,269	248	215	111	132	75	125	263	273	310	323	248	778
Male, All Causes	2,906	183	154	127	207	88	102	266	65	130	154	199	872
Female, All Causes	5,340	311	272	86	59	61	148	261	427	492	520	306	704
Female, All Except Genital and Puerperal	3,474	215	177	86	59	61	132	139	167	239	485	262	704

# *PRACTICAL PRIVATE DUTY NURSE*

## *Practical Nursing Cases<sup>2</sup> Per 1,000 Population*

Both Sexes, All Causes	272	8.58	7.06	2.36	1.57	1.31	1.97	15.57	18.62	7.59	3.88	8.15	28.06
Male, All Causes	35	2.21	1.85	3.21	1.77	1.74	.65	1.12	.42	.67	.54	7.46	11.44
Female, All Causes	237	13.78	12.08	1.49	1.38	.88	3.28	26.12	32.12	14.57	7.97	8.97	41.00
Female, All Except Genital and Puerperal	88	5.91	4.48	1.49	1.38	.88	.66	1.63	6.18	4.74	6.64	8.97	41.00

## *Practical Nursing Days<sup>3</sup> (Shifts) Per 1,000 Population*

Both Sexes, All Causes	5,088	189	132	15	36	11	18	201	263	103	127	219	1,374
Male, All Causes	660	53	35	23	45	13	2	16	3	2	10	300	343
Female, All Causes	4,428	299	226	7	27	7	35	336	450	206	272	123	2,176
Female, All Except Genital and Puerperal	2,232	184	114	7	27	7	3	21	57	64	239	123	2,176

# *VISITING NURSE OF ANY KIND*

## *Visiting Nursing Cases<sup>2</sup> Per 1,000 Population*

Both Sexes, All Causes	1,213	30.8	31.5	43.5	30.1	21.7	16.4	48.6	48.9	27.8	16.1	17.0	28.1
Male, All Causes	302	12.9	16.0	39.5	26.2	19.6	7.2	5.6	5.4	7.4	5.4	7.5	11.4
Female, All Causes	910	46.2	46.4	47.7	33.9	23.8	25.6	80.0	81.2	48.5	29.2	28.4	41.0
Female, All Except Genital and Puerperal	510	25.0	26.0	46.9	33.9	23.8	17.1	13.9	17.6	17.6	25.2	26.9	41.0

## *Nursing Visits<sup>3</sup> Per 1,000 Population*

Both Sexes, All Causes	8,155	230	212	192	117	124	98	333	391	237	144	168	510
Male, All Causes	1,619	83	86	175	102	121	33	85	48	34	34	26	295
Female, All Causes	6,535	359	333	211	131	127	164	513	645	443	279	338	677
Female, All Except Genital and Puerperal	3,366	193	171	207	131	127	96	68	155	155	232	333	677

## *Nursing Visits Per Case With Visiting Nurse<sup>4</sup>*

Both Sexes, All Causes	1,213	7.5	6.7	4.4	3.9	5.7	6.0	6.8	8.0	8.5	8.9	9.9	18.2
Male, All Causes	302	6.4	5.4	4.4	3.9	6.2	4.5	15.2	8.9	4.6	6.2	3.5	25.8

Male, All Causes	1,019	83	80	775	102	121	33	65	40	34	20	995
Female, All Causes	6,535	359	333	211	131	127	164	513	645	443	279	338
Female, All Except Genital and Puerperal	3,366	193	171	207	131	127	96	68	155	155	232	333
Nursing Visits Per Case With Visiting Nurse <sup>1</sup>												677
Both Sexes, All Causes	1,213	7.5	6.7	4.4	3.9	5.7	6.0	6.8	8.0	8.5	9.0	18.2
Male, All Causes	302	6.4	5.4	4.4	3.9	6.2	4.5	15.2	8.9	4.6	6.2	3.5
Female, All Causes	910	7.8	7.2	4.4	3.9	5.3	6.4	6.4	7.9	9.1	9.5	25.8
Female, All Except Genital and Puerperal	510	7.7	6.6	4.4	3.9	5.3	5.6	4.9	8.8	8.8	9.2	16.5
Per Cent of Total Cases <sup>1</sup> That Had Visiting Nurse												
Both Sexes, All Causes	32,752	3.7	3.7	3.6	3.1	3.2	2.7	7.2	6.0	3.6	2.1	2.0
Male, All Causes	14,596	1.8	2.1	3.2	2.6	2.9	1.3	1.2	9	1.2	9	1.3
Female, All Causes	18,146	5.0	5.0	4.0	3.5	3.5	4.0	9.6	8.3	5.2	3.2	2.9
Female, All Except Genital and Puerperal	10,666	3.0	3.1	4.0	3.5	3.6	2.9	2.2	2.3	2.2	2.9	3.8
POPULATION (YEARS OF LIFE)												
Both Sexes	38,544	—	—	5,513	5,715	4,568	3,050	2,119	5,640	5,030	3,351	1,473
Male	18,896	—	—	2,868	2,820	2,301	1,527	894	2,402	2,079	1,845	804
Female	19,627	—	—	2,684	2,895	2,267	1,523	1,225	3,238	2,951	1,506	669

<sup>1</sup> All ages includes a few of unknown age; both sexes includes a few of unknown sex.

<sup>2</sup> Rates in the form of cases, days or visits per 1,000 population are adjusted by the direct method to the age distribution of the white population of the death registration States in 1930 as a standard population (21); this population is given for specific ages in Table 1 of a preceding paper (4).

Figures in the "adjusted" column on days or visits per case represent the result of dividing the adjusted rate for days or visits per 1,000 by the corresponding adjusted rate for cases per 1,000; figures in the "adjusted" column for percentages of cases or visits represent the percentage that one adjusted rate per 1,000 is of another adjusted rate per 1,000.

<sup>3</sup> Cases represent periods of illness regardless of the number of diagnoses. Illness from accident is included along with that due to disease. Private nursing cases represent illnesses which had a full-time graduate nurse for one or more days or nights (shifts). General duty nursing in a hospital provided as part of the hospital care is not included. Visiting nursing cases represent those which had one or more visits by such a nurse.

Nursing cases include those with onset prior to but with nursing within the study year and those still sick and having a nurse at the end of the year of observation; nursing days and visits include only those within the study year. A nursing "day" means one nursing shift (day or night); if the case had three nurses within the twenty-four hours of a day, it was counted as three nursing days. Nursing cases were not included as nursing cases if the nursing was done by a volunteer or if the nursing was done by a family member. Cases were not recorded. In computing total nursing days or visits, nursing cases as well as cases with an unknown number of days or visits were put in at an average based on cases of the same diagnosis group with known nursing days or visits.

All rates and averages in this table which involve nursing days are exclusive of eight cases each of which had eight months or more of private duty nursing, mostly by practical nurses. These 0.9 per cent of the nursing cases were responsible for 16.0 per cent of the nursing days and thus would unduly influence all rates involving nursing days. See footnote 11 for details about these cases.

<sup>4</sup> Total cases include those with symptoms lasting one day or longer (disabling or nondisabling); disabling cases refer to those causing inability to work, attend school, care for the home, or pursue other usual activities for one day or longer regardless of age or employment status; bed cases refer to those confining the patient to bed or hospital for one day or longer; for further details and rates per 1,000 see Table 1 of a preceding paper (14).

<sup>5</sup> Hospital nursing cases refer to those with a private nurse while in a hospital, and hospital nursing days refer to those with a private nurse in a hospital. A few other hospital cases (twenty-five for all ages) had a private nurse at home but none in the hospital.

<sup>6</sup> Rates plotted in Figures 1 and 2 in broader age groups: Fig. 1, per cent of nursing days that were hospital nursing days, 15-24 years, male 80.0, female 42.8, female except 84.1; 55 years and over, male 36.3, female 18.0, female except 10.8; nursing days per case with private duty nurse, 15-24 years, male 15.7, female 11.7, female except 10.3; 55 years and over, male 19.4, female 28.4, female except 28.8; Fig. 2, graduate nursing days per 1,000, male 5-14 years 153, 15-24 years 103; practical nursing days per 1,000, male 5-14 years 31, 15-24 years 7; nursing visits per 1,000, male 5-14 years 111, 15-24 years 52.

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dered by practical nurses was 19 for males as compared with the percentages for females of 45 for all causes and 39 for diagnoses other than female genital and puerperal.

Of all private duty nursing cases for males 62 per cent were hospital cases with a private nurse while in the hospital, as compared with percentages for females of 48 for all causes and 58 for diagnoses common to the two sexes. The highest percentages for females occur between 10 and 25 years but for men they occur in the industrial ages between 20 and 45 years. The percentages of all nursing days that were rendered while the patient was in a hospital show even larger sex and age differences of this same kind.

It is seen in Figure 2 that visiting nursing rates in maternity cases, including pre and postnatal care, are much greater than those for full-time nursing. Some of this excess should be discounted; many of the canvassers in this study were health department nurses who gave only certain days to collecting these data, and pregnant women in the canvassed group would therefore become known to the health department and be more likely to be visited by a health department nurse. But aside from female genital and puerperal diagnoses, females of nearly every age received more visiting nursing than males of corresponding ages.

PERCENTAGE OF ILLNESSES BY DETAILED DIAGNOSIS WITH  
NURSING SERVICE OF ANY KIND

This paper is concerned primarily with nursing service rendered by full-time private nurses either in the hospital or in the home, and with visiting nursing. However, a considerable number of patients who are hospitalized but do not have a private nurse receive all the needed care from the general duty nurses available as a part of hospital care. Figure 3 shows for detailed diagnoses with fifty or more total cases the percentage that had nursing service of any kind; the bars are hatched in a way to show separately the proportion with a full-time private duty nurse, a general duty nurse

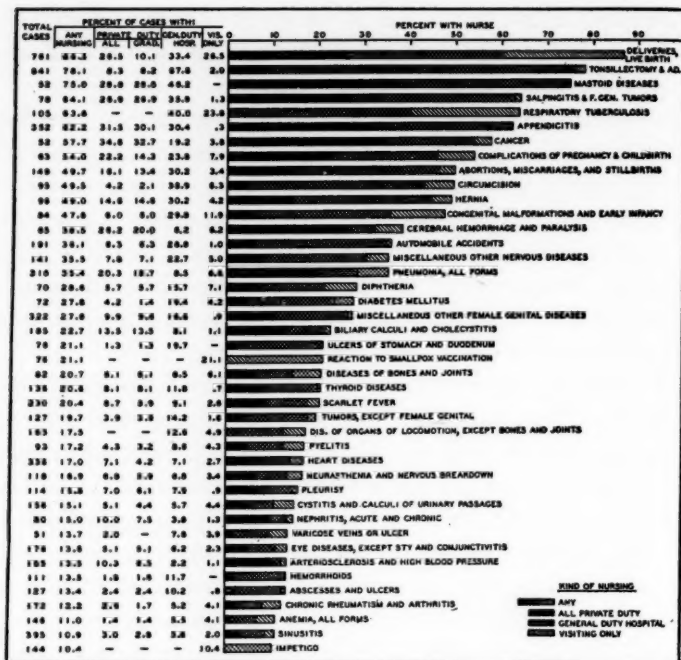


Fig. 3. Percentage of cases of detailed diagnoses that had nursing service of any kind—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole, primary, and contributory diagnoses for all specific causes with fifty or more total cases and with 10 per cent or more with some nursing service, including general duty nursing in hospitals.)

in a hospital without private nurse, and those who had only the services of a visiting nurse.

Of the deliveries with live birth, 86 per cent had some nursing service, 27 per cent by a full-time private nurse, 33 per cent by the general nurse in the hospital, and the remainder by a visiting nurse, including pre and postnatal visits. Although 78 per cent of the tonsillectomies had some nursing service, only 8 per cent had a private nurse, practically all of the service being received from the general duty nurse in the hospital. Cancer which is seventh in terms of the

proportion of cases with nursing care of any kind, had the highest percentage of cases with a private nurse, 35 per cent. Respiratory tuberculosis which is fifth in terms of any nursing service, had no private duty nursing but 40 per cent of the cases were in a hospital and had the care of the general duty nurse and an additional 24 per cent had a visiting nurse. The various diagnoses need not be cited in detail; a study of Figure 3 will indicate what kind of nursing service was received by patients with the different diseases. In some instances a high percentage with nursing care is due to high proportions hospitalized while in others it is due largely to visiting nursing service. In a few of the more serious illnesses the percentages with private duty nursing are considerable. The diagnoses shown in Figure 3 include all causes which had 4 per cent or more of the cases with a private duty nurse.

Although not shown in the bars in Figure 3, the data at the left show for each diagnosis the percentage of cases who had a graduate nurse, the remainder of the private duty nursing being rendered by practical nurses. In terms of the proportions of cases with a graduate nurse the diagnoses which had the most care are cancer, 33 per cent; appendicitis, 30 per cent; mastoid diseases, 29 per cent; and salpingitis and tumors of the ovary and uterus, 27 per cent.

In practical nursing, deliveries with live birth head the list with 16 per cent of the cases with such a nurse, followed by complications of pregnancy, 8 per cent, cerebral hemorrhage and paralysis, 6 per cent, and scarlet fever, 5 per cent. Of the eleven diagnoses with 2 per cent or more of the cases with a practical nurse, six are degenerative diseases and four relate to pregnancy, childbirth, and infancy.

In visiting nursing (Fig. 4) two diagnoses are far above all others—deliveries with live birth 47 per cent, and respiratory tuberculosis 40 per cent. For the next diagnosis, the cases in which illness or considerable reaction followed smallpox vaccination, the proportion of patients who had a visiting nurse was 21 per cent, followed by

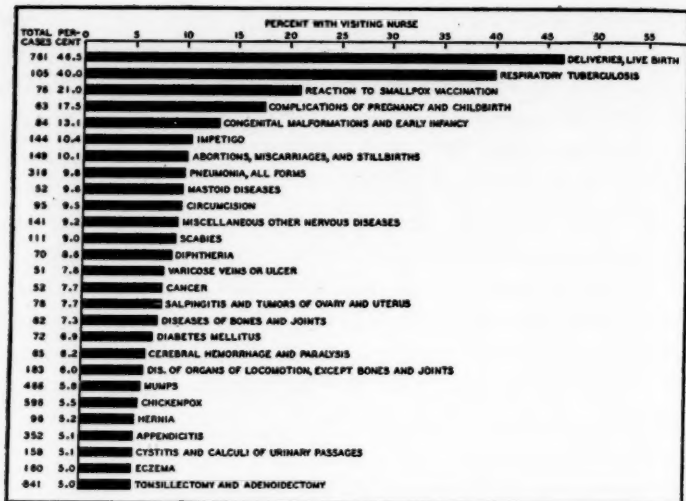


Fig. 4. Percentage of cases of detailed diagnoses that had a visiting nurse—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole, primary, and contributory diagnoses for all specific causes with fifty or more cases and with 5 per cent or more with a visiting nurse.)

complications of pregnancy, 17 per cent, and malformations and diseases of early infancy, 13 per cent. Visiting nursing of the type reported in this study centers rather largely around pregnancy, maternity and infancy, vaccination, and tuberculosis.

#### IMPORTANT DIAGNOSIS GROUPS IN NURSING SERVICE

Although the total number of illnesses with nursing care was not large, it seems worth while to consider in more detail a limited number of diseases and conditions most important as causes of nursing care. The following charts show the sixteen diagnosis groups that had fifteen or more cases with a full-time private duty nurse or fifteen or more cases with a visiting nurse or both.

*Nursing Case and Day Rates.* Figure 5 shows for these sixteen diagnoses nursing cases per 1,000 population under observation in terms of (a) full-time private duty nursing, separately for graduate and practical, and (b) visiting nursing. The bars are arranged for

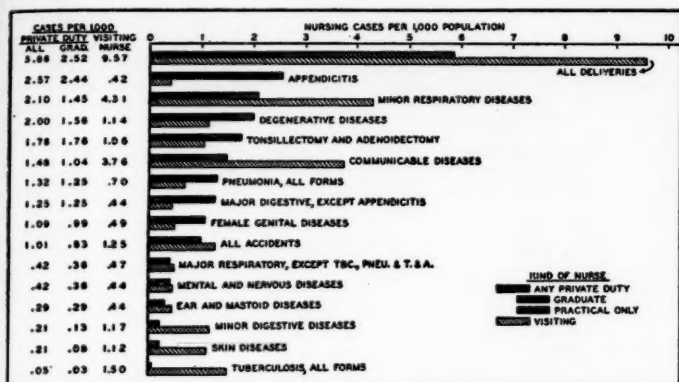


Fig. 5. Annual frequency of cases of graduate, practical, and visiting nursing for certain diagnoses per 1,000 population—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole or primary diagnoses for causes with fifteen or more cases of private duty or of visiting nursing.)

comparing the extent of private duty and visiting nursing on the same diagnosis, being arrayed according to the total private duty rates. Deliveries stand out as the diagnosis with the most frequent nursing care of all three types. The rate for visiting nurse on maternity cases (including pre and postnatal care) is more than twice the visiting rate for the next most frequent diagnosis group, minor respiratory diseases. It has already been noted that the high visiting nurse rate for maternity cases may be due in part to the fact that some of the canvassers in this study were health department employees who no doubt brought pregnancies in the surveyed families to the attention of the health authorities at an earlier stage than would occur in other families. Other diagnoses with relatively high visiting nurse rates are communicable diseases and tuberculosis. Diagnoses with relatively high case rates for private duty nurses are, in addition to deliveries, appendicitis, minor respiratory diseases, degenerative diseases, and tonsillectomy. In most of the diagnoses except deliveries, the great majority of the private duty cases had a graduate nurse.

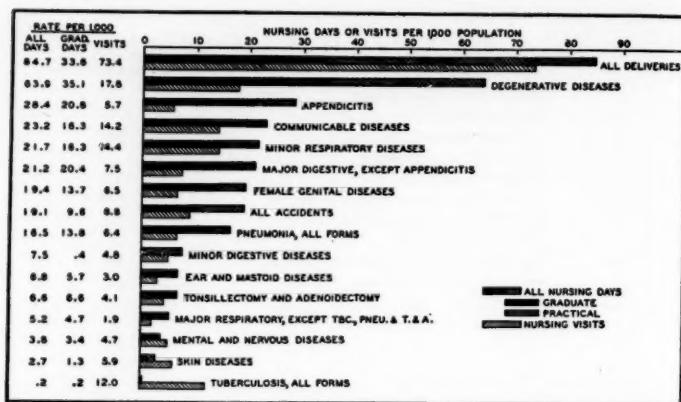


Fig. 6. Annual volume of graduate, practical, and visiting nursing days and visits for certain diagnoses per 1,000 population—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole or primary diagnoses for the sixteen causes included in Fig. 5.)

Figure 6 shows for the same sixteen diagnoses nursing days per 1,000 population for private duty nursing care (within and outside of hospitals) with separation of graduate and practical days, and the number of nursing visits per 1,000 population. In terms of nursing cases (Fig. 5) only delivery had a sizable rate for practical nurses, but in nursing days degenerative diseases, accidents, and several other diagnoses had relatively large rates for practical nurses. The difference is obviously due to the longer average days per case for practical nurses.

The average days (practical and graduate) of nursing per case with a private nurse exceed the average visits per case with a visiting nurse in nine of the thirteen diagnoses with ten or more cases of both kinds of nursing (Fig. 7). The days per case with a private duty nurse range from 33.3 for degenerative diseases to 3.8 for tonsillectomy. Visits per case with a visiting nurse range from 17.1 for major digestive diseases to 3.3 for minor respiratory diseases.

*Percentage of Cases with Nursing Service.* Figure 8 and Table 2 show for the same sixteen diagnoses the proportions of all cases

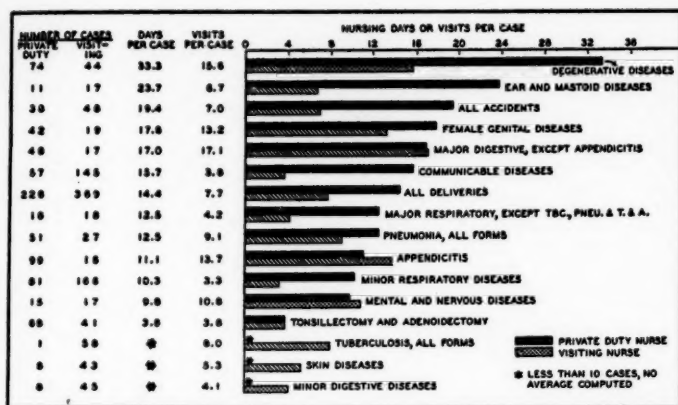


Fig. 7. Nursing days per case with a private duty nurse and nursing visits per case with a visiting nurse, for certain diagnoses—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole or primary diagnoses for the sixteen causes included in Fig. 5.)

with one or more days of private nursing with separation for graduate and practical, and with one or more visits by a nurse. At the top of the list in terms of private nursing is appendicitis with 31 per cent of the cases with such a nurse but only 5 per cent with a

Fig. 8. Percentage of cases of certain diagnoses that had graduate, practical, or visiting nurses—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole or primary diagnoses for the sixteen causes included in Fig. 5.)

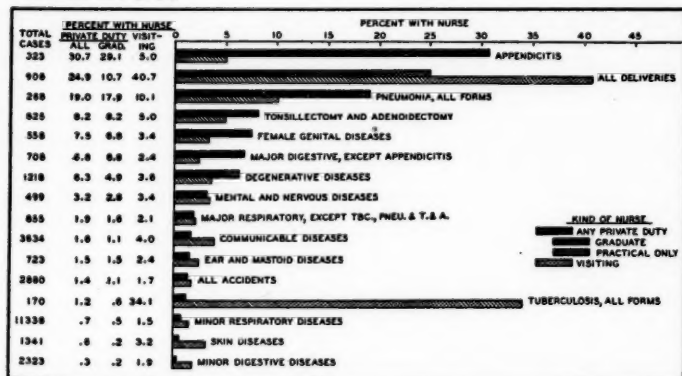


Table 2. Percentage of illnesses<sup>1</sup> of certain diagnoses which had nursing service of specified kinds—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole or primary diagnoses only.)

DIAGNOSES	PER CENT OF CASES WITH:								
	TOTAL CASES OF ILLNESS <sup>2</sup>	Any Nursing, Including General Duty Nurse in Hospital	Full-Time Private Duty Nurse (Graduate or Practical)	General Duty Nurse in Hospital But No Private Nurse	Visiting Nurse Only	Graduate Nurse <sup>3</sup>	Practical Nurse <sup>3</sup>	Visiting Nurse <sup>3</sup>	Other Help <sup>3</sup>
1	2	3	4	5	6	7	8	9	
ALL CAUSES	32,752	11.2	2.8	5.7	2.7	2.1	.82	3.7	1.20
Tonsillectomy and Adenoidectomy	825	78.3	8.2	68.0	2.1	8.2	—	5.0	.85
Pneumonia, All Forms	268	33.2	19.0	7.5	6.7	17.9	2.61	10.1	5.22
Minor Respiratory Diseases	11,336	2.4	.7	.3	1.4	.5	.26	1.5	.33
Other Respiratory Diseases	855	8.0	1.9	4.3	1.8	1.6	.35	2.1	.58
Appendicitis	323	60.4	30.7	29.4	.3	29.1	2.48	5.0	4.64
Minor Digestive Diseases	2,323	2.9	.3	.7	1.9	.2	.13	1.9	.26
Other Digestive Diseases	708	18.5	6.8	10.3	1.4	6.8	.28	2.4	1.41
All Accidents	2,880	8.7	1.4	5.9	1.5	1.1	.31	1.7	.52
All Deliveries and Abortions	906	80.7	24.9	32.9	22.8	10.7	15.78	40.7	20.97
Female Genital Diseases	558	21.5	7.5	13.1	.9	6.8	.90	3.4	4.12
Degenerative Diseases	1,218	15.5	6.3	7.0	2.2	4.9	1.97	3.6	1.48
Communicable Diseases	3,644	6.9	1.6	1.5	3.9	1.1	.47	4.0	.38
Ear and Mastoid Diseases	723	7.9	1.5	5.0	1.4	1.5	.14	2.4	.28
Skin Diseases	1,341	5.1	.6	1.4	3.1	.2	.37	3.2	.07
Tuberculosis, All Forms	170	57.1	1.2	33.5	22.4	.6	.59	34.1	3.53
Mental and Nervous Diseases	499	13.2	3.2	7.2	2.8	2.8	.60	3.4	.60
All Other Diseases	4,175	8.4	1.4	4.6	2.5	1.2	.24	2.9	.65

<sup>1</sup> Cases of illness include all reported in the periodic canvasses, both disabling and nondisabling.

<sup>2</sup> The total number of illnesses reported in the periodic canvasses. Some cases had two or more types of nurses or attendants; percentages in columns 3, 4 and 5 are mutually exclusive with their total in column 2.

visiting nurse. Deliveries come second for private nurse, 25 per cent, but 41 per cent had a visiting nurse, including pre and postnatal care. For ten of the sixteen diagnoses the percentage was greater for visiting than for private duty nurse. Table 3 shows similar data in broad age groups.

Of all illnesses among males 1.8 per cent had a full-time private nurse for one or more days, as compared with percentages for females of 3.5 for all illnesses and 2.2 for all except female genital and puerperal diagnoses. Figure 9 shows by sex and for fourteen important diagnoses common to the two sexes the percentage of cases with a private nurse. The percentages with such a nurse were higher for females for nine diagnoses and higher for males for the other five causes. For visiting nursing thirteen of the same fourteen diagnoses had higher percentages with such a nurse for females than males, the only exception being tonsillectomy. Illness rates for given diagnoses are generally higher for females than males (14), and it appears that women are somewhat more likely than men to have a nurse of some kind for a given case; again it must be re-

Fig. 9. Percentage of cases of certain diagnoses among males and females that had a private duty nurse—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole, primary, and contributory diagnoses for the causes included in Fig. 5, except female genital and puerperal diagnoses.)

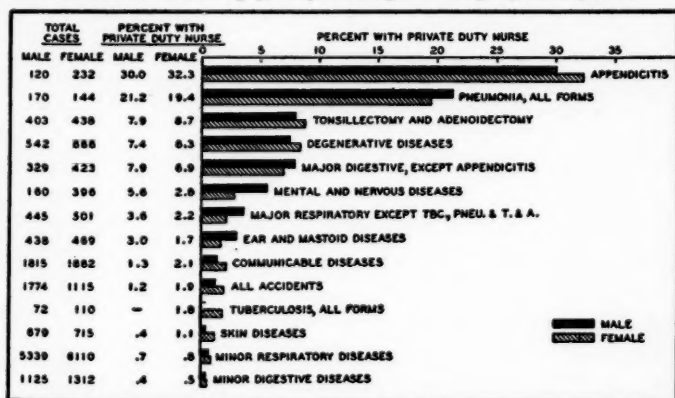


Table 3. Age variation in the percentage of illnesses<sup>1</sup> from certain diagnoses which had a nurse of the specified kind—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole, primary, and contributory diagnoses.)

DIAGNOSIS	ALL AGES <sup>1</sup>	AGE				ALL AGES <sup>1</sup>	AGE			
		Under 5	5-14	15-44	45 and Over		Under 5	5-14	15-44	45 and Over
	PER CENT OF CASES <sup>1</sup> WITH FULL-TIME PRIVATE DUTY NURSE OF ANY KIND					PER CENT OF CASES <sup>1</sup> WITH VISITING NURSE				
Tonsillectomy and Adenoidectomy	8.3	10.1	6.4	9.0	19.2	5.0	6.0	6.2	2.4	—
Pneumonia, All Forms	20.3	14.6	19.0	27.6	31.0	9.8	11.5	7.1	10.3	9.5
Minor Respiratory Diseases	.7	.8	.5	.7	1.4	1.5	2.1	1.8	1.0	1.0
Other Respiratory Diseases	2.9	1.4	2.3	2.5	5.3	2.6	7.0	4.0	1.7	2.4
Appendicitis	31.5	*	33.3	30.4	45.5	5.1	*	2.4	5.5	13.6
Minor Digestive Diseases	.4	.4	—	.4	1.0	1.9	3.4	.6	1.6	1.0
Other Digestive Diseases	7.3	.9	3.5	7.7	11.7	2.5	5.5	—	2.1	2.5
All Accidents	1.5	.5	.9	1.4	3.7	1.7	1.8	1.6	1.5	2.1
All Deliveries and Abortions <sup>3</sup>	24.8	*	*	25.0	*	40.5	*	*	40.4	*
Female Genital Diseases	9.4	*	*	9.2	12.4	4.3	*	*	3.9	5.6
Degenerative Diseases	8.0	1.9	2.5	5.0	11.5	4.0	1.9	5.9	3.3	4.4
Communicable Diseases	1.7	.8	1.2	4.9	6.5	4.0	3.5	4.4	4.0	2.3
Ear and Mastoid Diseases	2.3	1.3	3.0	3.3	1.4	3.0	3.8	4.3	.9	—
Skin Diseases	.8	.4	.4	.9	1.2	3.4	7.4	4.5	1.1	2.4
Tuberculosis, All Forms	1.1	*	—	2.2	*	33.5	*	35.0	30.4	*
Mental and Nervous Diseases	3.6	1.7	—	2.8	8.2	4.0	5.2	9.5	2.8	3.0
	NUMBER OF CASES WITH FULL-TIME PRIVATE DUTY NURSE OF ANY KIND					NUMBER OF CASES WITH VISITING NURSE				
Tonsillectomy and Adenoidectomy	70	15	29	19	5	42	9	28	5	—
Pneumonia, All Forms	64	19	16	16	13	31	15	6	6	4
Minor Respiratory Diseases	85	20	17	27	21	169	57	56	41	15
Other Respiratory Diseases	27	1	4	13	9	25	5	7	9	4
Appendicitis	111	1	28	72	10	18	—	2	13	3
Minor Digestive Diseases	10	3	—	3	4	46	27	3	12	4
Other Digestive Diseases	55	1	3	26	25	19	6	—	7	6
All Accidents	43	2	8	17	15	50	7	14	18	11
All Deliveries and Abortions	226	—	—	226	—	369	—	—	365	4
Female Genital Diseases	59	—	—	47	11	27	2	—	20	5
Degenerative Diseases	114	1	3	26	84	57	1	7	17	32
Communicable Diseases	62	11	23	22	6	147	46	81	18	2
Ear and Mastoid Diseases	21	4	9	7	1	27	12	13	2	—
Skin Diseases	11	1	2	5	2	48	18	20	6	4
Tuberculosis, All Forms	2	—	—	2	—	61	3	21	28	9
Mental and Nervous Diseases	20	1	—	8	11	22	3	7	8	4

<sup>1</sup> Cases of illness include all reported in the periodic canvasses, both disabling and nondisabling.

<sup>2</sup> All ages includes a few of unknown age.

<sup>3</sup> The number of deliveries was large enough for five-year groups from 20 to 44 years. The percentages with graduate nurse increased rather regularly from 6 at 20-24 to 15 at 40-44 years; those for practical nurse varied irregularly from 15 to 18 per cent in the ages from 20 to 40 years but was only 4 per cent at 40-44 years. The percentages for visiting nurse were about 42 at both 20-24 and 40-44 years, with a consistent decrease from these extremes to a minimum of 37 per cent at 30-34 years.

\* Less than twenty total cases (including none) and no percentage computed.

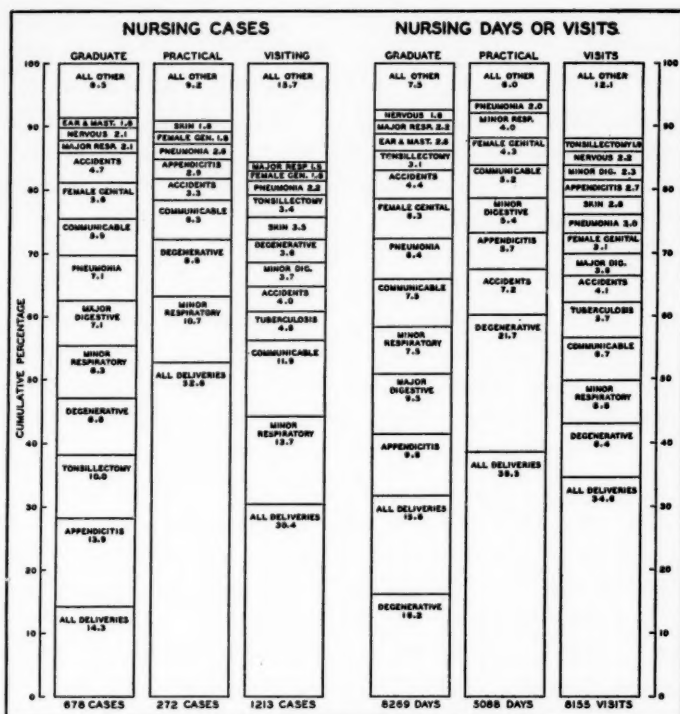


Fig. 10. Percentage of graduate, practical, and visiting nursing cases and days or visits that were due to each diagnosis—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole or primary diagnoses; each bar shows the 16 causes included in Fig. 5 except where less than 1.5 per cent.)

membered that the housewife often does the family nursing but cannot be her own nurse.

**Nursing Case Load.** The data on nursing care may be considered from the point of view of the distribution of the nurse's case load in terms of the diagnoses of the patients served. Figure 10 shows these distributions in terms of cases and days for graduate and practical nursing and in terms of cases and visits for visiting nursing.

Of the total cases with a full-time graduate nurse, 14 per cent

were deliveries, with appendicitis only slightly less. Of the practical nursing cases, 53 per cent were deliveries, with appendicitis sixth in the list with only 3 per cent. Maternity cases, including pre and postnatal care, accounted for 30 per cent of the visiting nursing cases. Minor respiratory diseases were second among practical nursing cases, 11 per cent, and second among visiting cases with 14 per cent of the total visiting cases.

Of the total graduate nursing days, 16 per cent were for the degenerative diseases with deliveries only slightly less. The same causes head the list for practical nursing days with 38 per cent for deliveries and 22 per cent for degenerative diseases<sup>14</sup>. Thus in days these two causes make up 60 per cent of the practical nurse's load.

Deliveries and degenerative diseases appear among the first five important causes of nursing according to nearly every measure of nursing set up in Figure 10; appendicitis and minor respiratory diseases (and their complications) appear among the first five causes according to most of the measures of nursing care; other causes are important in certain kinds of nursing but not in others.

*Distribution of Cases According to Nursing Days and Visits.* Table 4 shows the distribution of cases according to the days (shifts) of care by a graduate and by a practical nurse; since some cases had both types of nurses, the column for all private duty nursing is not merely the sum of the frequencies for graduate and practical nurses but a new distribution of cases according to the total days of nursing. The peculiar class intervals used are designed to put near the center of the group the round numbers that occur frequently in these reports; 7 and multiples of 7, 10, and 30 days occur with unusual frequency because the data are given by family informants rather than copied from nursing records, and because at least practical nurses are frequently hired by the week. In 12 per cent of the cases with a graduate nurse, the care was for only a single day (or

<sup>14</sup> With the eight long cases (see footnote 11) included, degenerative diseases were responsible for 18.0 per cent of all graduate and 27.6 per cent of all practical days; deliveries accounted for 14.1 per cent of graduate and 28.8 per cent of practical nursing days.

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NURSING DAYS OF SPECIFIED DURATION	ALL CAUSES			ALL DELIVERIES AND ABORTIONS			ALL OTHER CAUSES		
	Any Private Duty Nurse	Graduate Nurse	Practical Nurse	Any Private Duty Nurse	Graduate Nurse	Practical Nurse	Any Private Duty Nurse	Graduate Nurse	Practical Nurse
Total Cases With Known Days									
Number	879	660	261	219	93	139	660	567	122
Per Cent	100	100	100	100	100	100	100	100	100
1	9.4	12.3	3.1	7.3	21.5	.7	10.2	10.8	5.7
2	7.8	9.8	4.6	2.7	5.4	1.4	9.5	10.6	8.2
3	6.5	8.2	2.7	1.8	5.4	1.4	8.0	8.6	4.1
4-5	10.6	12.1	5.4	4.1	6.5	2.9	12.7	13.1	8.2
6-8	14.3	15.8	11.9	11.9	12.9	11.5	15.2	16.2	12.3
9-11	9.1	7.4	13.8	16.0	9.7	20.1	6.8	7.1	6.6
12-17	18.8	13.5	31.8	32.4	11.8	42.4	14.2	13.8	19.7
18-24	9.3	8.5	10.3	11.9	9.7	12.2	8.5	8.3	8.2
25-38	6.3	5.8	6.9	8.2	10.8	6.5	5.6	4.9	7.4
39-66	4.1	4.2	3.1	2.7	3.2	.7	4.5	4.4	5.7
67 and Over	3.8	2.4	6.5	.9	3.2	—	4.7	2.3	13.9

Table 4. Percentage distribution of private duty nursing cases<sup>1</sup> according to days of graduate and of practical nursing—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole or primary diagnoses only.)

<sup>1</sup> Some cases had both a graduate and a practical nurse. All cases are classified according to days for each type of nurse regardless of days on the same case for the other type; in days for "any private duty nurse" the cases are classified according to total days for both graduate and practical nurses.

night), as compared with 3 per cent for a practical nurse; 42 per cent of the graduate cases were for five days (shifts) or less, as compared with 16 per cent for practical nurses.

Table 5 shows similar distributions for as many of the sixteen diagnoses as had twenty-five or more cases of sole diagnosis with a private duty nurse. The percentage of cases with a nurse and the mean days per case are shown for illnesses with sole diagnosis and for complicated cases, that is, those with two or more diagnoses. For all nine diagnoses the complicated cases had higher percentages with a nurse and more nursing days per case than the uncomplicated ones.

Similar distributions of cases according to the number of nursing visits are shown in Table 6. Thirty-nine per cent of all illnesses with such a nurse had only one or two visits; for uncomplicated cases of

NURSING DAYS	APPENDICITIS	MAJOR DIGESTIVE DISEASES	TONSILLECTOMY AND ADENOIDECTOMY	PNEUMONIA, ALL FORMS	MINOR RESPIRATORY DISEASES	COMMUNICABLE DISEASES	DEGENERATIVE DISEASES	FEMALE GENITAL DISEASES	ACCIDENTS
CASES WITH ONLY ONE DIAGNOSIS (UNCOMPLICATED)									
Total Cases With Known Nursing Days	85	37	62	40	66	48	39	29	34
Number	100	100	100	100	100	100	100	100	100
Per Cent									
1	5.9	5.4	35.5	—	4.5	6.2	7.7	—	23.5
2-3	18.8	10.8	40.3	12.5	13.6	12.5	17.9	31.0	17.6
4-5	20.0	16.2	4.8	25.0	13.6	12.5	2.6	10.3	11.8
6-8	18.8	16.2	6.5	7.5	25.8	14.6	5.1	20.7	11.8
9-11	9.4	2.7	4.8	7.5	13.6	6.2	2.6	6.9	—
12-17	12.9	16.2	3.2	25.0	25.8	12.5	15.4	13.8	11.8
18-24	10.6	10.8	4.8	12.5	1.5	14.6	7.7	6.9	8.8
25 and Over	3.5	21.6	—	10.0	1.5	20.8	41.0	10.3	14.7
Mean Nursing Days	8.7	15.5	3.8	12.4	8.8	16.6	30.3	15.2	17.5
Per Nursing Case <sup>2</sup>									
Per Cent of Cases With a Nurse	29.6	5.8	8.0	16.7	.6	1.4	4.2	5.8	1.2
CASES WITH TWO OR MORE DIAGNOSES (COMPLICATED)									
Total Cases With Known Nursing Days	24	17	7	24	15	11	67	29	7
Mean Nursing Days									
Per Nursing Case <sup>2</sup>	22.4	19.1	9.6	16.5	19.3	16.8	44.5	16.6	25.6
Per Cent of Cases With a Nurse	41.0	17.2	14.0	31.2	2.4	7.1	17.3	23.6	17.3

Table 5. Percentage distribution of private duty<sup>1</sup> nursing cases of certain diagnoses according to the number of nursing days—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931.

<sup>1</sup> Includes both graduate and practical nursing.

<sup>2</sup> Eight cases with 252 days or more of nursing care are excluded from the computation of mean days per case. See footnote 11 for details about these cases.

communicable disease 71 per cent received only one or two visits.

#### NURSING FOR SURGICAL AND NONSURGICAL CASES

Of all illnesses reported in this study 2.8 per cent had a full-time private nurse for one or more days or nights either in or outside of a hospital; 20.3 per cent of the hospital cases had such a nurse while in the hospital and 1.4 per cent of the nonhospital cases had a private nurse. Of the surgical hospital cases, 24 per cent had a private

Acci- DENTS	NURSING VISITS	SOLE OR PRIMARY DIAGNOSES			SOLE DIAGNOSIS ONLY						
		All Causes	All Deliveries and Abortions	All Other Causes	Com- muni- cable Diseases	Minor Respira- tory Diseases	Tonsillec- tomy and Adenoid- ectomy	Minor Digestive Diseases	Degen- erative Diseases	Acci- dents	Tuber- culosis
	Total Cases With Known Visits										
	Number	1,180	365	815	133	143	35	44	35	47	52
	Per Cent	100	100	100	100	100	100	100	100	100	100
34	1-2	38.7	20.8	46.7	71.4	60.8	45.7	56.8	14.3	42.6	26.9
100	3-4	20.3	17.3	21.7	15.8	23.8	40.0	25.0	8.6	29.8	19.2
23.5	5-6	10.2	12.9	9.0	3.0	8.4	2.9	6.8	20.0	4.3	15.4
17.6	7-8	6.7	11.5	4.5	1.5	.7	8.6	4.5	2.9	4.3	7.7
11.8	9-10	5.8	11.2	3.4	.8	2.1	—	2.3	8.6	2.1	5.8
11.8	11-12	5.4	12.1	2.5	.8	1.4	—	—	5.7	2.1	3.8
—	13-19	6.1	9.6	4.5	3.8	2.8	2.9	2.3	8.6	6.4	13.5
11.8	20-29	3.8	4.1	3.7	2.3	—	—	—	11.4	2.1	3.8
8.8	30-39	.7	.5	.7	—	—	—	—	5.7	2.1	1.9
14.7	40 and Over	2.2	—	3.2	.8	—	—	2.3	14.3	4.3	1.9

Table 6. Percentage distribution of visiting nursing cases of certain diagnoses according to the number of nursing visits—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931.

nurse while in the hospital, as compared with 15 per cent for nonsurgical hospital cases. These figures may be compared with 1.9 per cent with a private nurse for surgical nonhospital cases and 1.4 for nonsurgical nonhospital cases.

Of all cases with a full-time private nurse, 52 per cent had a private nurse while in a hospital. Of all surgical cases with a private nurse, 95 per cent had a private nurse while in a hospital, as compared with 24 per cent for all nonsurgical cases with a private nurse.

Of the total cases with a full-time private nurse, 40 per cent were surgical; these surgical cases account for 37 per cent of the days (shifts) of private duty nursing, exclusive of the eight long cases previously discussed. Of the hospital cases with a private nurse while in the hospital, 72 per cent were surgical, but of the non-hospital cases with a private nurse only 4 per cent were surgical. These various figures indicate a considerable concentration of private duty nursing service in hospitals, particularly on hospital surgical cases.

Visiting nursing service is somewhat less concentrated on hospital and surgical cases. Of all illnesses reported in this study 3.7 per cent had one or more visits from a nurse; 10.9 per cent of the hospital cases and 3.1 per cent of the nonhospital cases had such nursing service. Of the surgical hospital cases 5.9 per cent had a visiting nurse either before or after the period of hospitalization, as compared with 18.9 per cent for nonsurgical hospital cases. These figures may be compared with 3.4 per cent with a visiting nurse for surgical nonhospital cases and 3.1 per cent for nonsurgical nonhospital cases.

Of all cases with a visiting nurse, 21 per cent were hospital cases. Of the surgical cases with a visiting nurse, 71 per cent were hospital cases, as compared with 16 per cent for nonsurgical cases with such a nurse.

Of all cases with a visiting nurse, 10 per cent were surgical and 90 per cent nonsurgical; of the hospital cases with a visiting nurse before or after the period of hospitalization, 33 per cent were surgical and of the nonhospital cases with such a nurse 4 per cent were surgical.

Fig. 11. Percentage of surgical and of nonsurgical cases of certain diagnoses that had a private duty nurse—8,758 canvassed white families in eighteen States during twelve consecutive months, 1928-1931. (Sole, primary, and contributory diagnoses for as many of the sixteen causes included in Fig. 5 as had fifty or more of either surgical or nonsurgical cases and 3.0 per cent or more with a nurse for either category.)

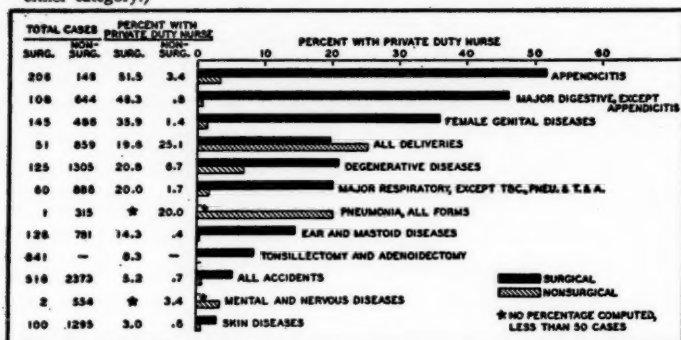


Figure 11 compares for important diagnoses the percentage of surgical and nonsurgical cases with a full-time private nurse for one or more days. Of the twelve diagnoses, nine had enough of both surgical and nonsurgical cases to use as a basis for percentages; of these nine diagnoses, eight had definitely higher percentages of surgical than of nonsurgical cases with a private nurse. Appendicitis is at the top of the list with a private nurse for 51 per cent of the surgical cases and 3 per cent of the nonsurgical. The excesses for surgical cases were extremely large for nearly every diagnosis. Deliveries, pneumonia, and degenerative diseases were the only diagnoses which had considerable percentages of nonsurgical cases with a private nurse.

#### SUMMARY

Data on the frequency of illness and nursing care were recorded for a twelve-month period between 1928 and 1931 by periodic canvasses of 8,758 white families in 130 localities in eighteen States. The surveyed families include representation from nearly all geographic sections, from rural, urban, and metropolitan areas, from all income classes and of both native and foreign-born persons. Visits were made at intervals of two to four months. Illnesses causing symptoms for one day or longer were recorded, together with the number of cases with a private duty or visiting nurse and the days and visits within the study year.

Of all illnesses 11.2 per cent had some nursing service. In about half of the cases with nursing service, the nursing was done by the general duty hospital nurse as a part of the hospital care; 2.1 per cent had a full-time private duty graduate nurse, 0.7 per cent a practical nurse and 2.7 per cent had a visiting nurse only. Of all cases 3.7 per cent had a visiting nurse alone or with some other type of nursing, 0.8 per cent had a practical nurse alone or with a graduate nurse, and 1.2 per cent had some additional domestic help because of the illness.

Of the bed cases 5 per cent had a full-time private nurse and 20 per cent of the hospital cases had such a nurse while in the hospital, but only 1.4 per cent of the nonhospital cases had a private nurse. Of the illnesses with a graduate private nurse 70 per cent had such a nurse while in a hospital and of all graduate nursing days and nights (shifts) 63 per cent were rendered in hospitals. Of all hospital cases 10.9 per cent had a visiting nurse before or after the period spent in the hospital, but only 3.1 per cent of the nonhospital cases had such a nurse.

Of all surgical cases 15 per cent had a full-time private nurse as compared with 2 per cent for nonsurgical cases. Of the surgical hospital cases 24 per cent had a private duty nurse while in the hospital, as compared with 15 per cent for nonsurgical hospital cases. Neither surgical nor nonsurgical nonhospital cases had much nursing, 1.9 and 1.4 per cent respectively. Surgical cases of appendicitis had the highest proportion with a private nurse (51 per cent) with other abdominal operations (major digestive) a close second (46 per cent). Surgical cases rather consistently had much more nursing than nonsurgical cases of the same diagnosis.

Graduate private nursing amounted to 19.4 cases and 248 days, and practical nursing to 8.6 cases and 189 days per 1,000 population under observation. Visiting nursing amounted to 30.8 cases and 230 visits per 1,000 population. Aside from a very large excess in the childbearing ages for both private duty and visiting nursing cases and also for nursing days and visits, nursing rates tend to rise with age after 15 and particularly after 45 years. Although there is somewhat more nursing under 5 years than in adolescence, the excess is not striking.

In terms of all kinds of nursing, delivery with live birth (including pre and postnatal care) had a higher percentage of cases with a nurse than any other diagnosis (86 per cent). Approximately one-sixth of this nursing was done by a graduate private nurse, one-sixth by a practical private nurse, one-third by the general duty hospital

nurse, and one-third by a visiting nurse. In all private duty nursing delivery was fifth in the percentage with such a nurse (27 per cent). The diagnoses with higher percentages with a private duty nurse were cancer (35 per cent), appendicitis (32), mastoid diseases (29), and salpingitis and female genital tumors (27 per cent). The diagnoses with the highest percentages of cases with a visiting nurse were delivery (47 per cent), respiratory tuberculosis (40), smallpox vaccinations (21), complications of pregnancy and childbirth (17), and congenital malformations and diseases of early infancy (13 per cent).

Females had more cases with a private nurse and more days of nursing per 1,000 population than was true of males. Females also had a higher percentage of their illnesses attended by a full-time private nurse; these statements are true even when female genital and puerperal diagnoses are eliminated. The excess in visiting nursing for females over males was considerably greater than for private duty nursing. These excesses in nursing for females, particularly visiting nursing, are rather consistently true for the various diagnoses for which nursing care was frequent.

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THE AGE-SEX COMPOSITION OF THE POPULATION RESULTING FROM NATALITY AND MORTALITY CONDITIONS

J. YERUSHALMY<sup>1</sup>

WHEN society began to count and record births and deaths, two interesting facts began to emerge about the two sexes. The first is that the sex distribution at birth is not equal; more boys than girls are born every year. The second is that the female, considered "the weaker sex," is able to withstand the forces of mortality better than the male; the death rates at practically all ages are higher for males than for females. That these facts were entirely unexpected may be judged from the following remark made by John Graunt in 1676 relative to the bills of mortality: "Nor could I ever yet learn (from the many I have asked and those not of the least *Sagacity*) to what purpose the distinction between *Males* and *Females* is inserted, or at all taken notice of?" (1; p. 18).

Each of these two facts has an interest of its own. Studies of the unequal distribution of the sexes at birth are closely related to the problem of sex determination. From investigations on the differential mortality by sex, it is hoped to gain a better insight into the environmental and congenital manifestations of many illnesses. However, it would appear that much may be gained if the differential mortality by sex and the differences in the sex ratio at birth are studied together. A clearer picture of the age and sex composition of the population may be obtained if all the known facts about both the natality and mortality conditions are considered.

The quantitative aspects of the future population of the United States depend at present almost entirely on the natural processes of

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birth and death, since only a negligible part of the growth of the population is due to immigration. The ultimate age-sex composition of the population will depend largely on the ratio of the sexes at birth and on the age-specific mortality rates of the two sexes.<sup>2</sup> It is, therefore, of interest to inquire how those factors will affect the age-sex composition of the population. What will be the resulting ratio of the sexes at each age? How long will it take for the differential mortality by sex to exhaust the numerical superiority of the males at birth? How large will be the numerical superiority of the females at various ages after the 50-50 mark is reached? What is the *form* of the sex-ratio curve by age? How does that theoretical curve compare with the actual curve obtained from the census of population?

The social implications of the age-sex distribution of the population are numerous. Men still are the main producers of goods. Men, during the occupationally active ages, not only support their families during their lifetime, but have the added responsibility of providing, through savings and insurance, for those parts of the population who survive them. The age-sex composition of the population is vital for old-age and survivors' insurance plans. It is an important consideration in the problems of marriage, widowhood, and orphanhood. The curve of sex ratios by age is also of interest in the evaluation of the differential mortality by sex. The factors that may enter into this selective mortality may be partly biological and partly due to the extra hazards to the male which are mainly the result of his occupational activities. The female, on the other hand, is exposed to the extra risk which is associated with childbearing. The period of childbearing coincides with the occupationally most active period of the male. Study of the form of the age-sex curve before, during, and after the childbearing period may therefore throw additional light on the extent of the influences

<sup>2</sup>It should be noted that the ultimate age composition of the population depends also on the age-specific fertility rates, whereas the ratio of the sexes at each age depends only on the sex ratio at birth and on the age-specific mortality rates of the two sexes.

which these extra risks have on the mortality of the two sexes.

The theoretical age-sex distribution of the population which results from the natality and mortality conditions operating on the population in a given year may be obtained by applying, to an arbitrary number of live births, the known sex ratio at birth and the age-specific death rates for the two sexes. For example, if 51.5 per cent of the births in a locality are male, among 100,000 infants born alive at the same time, there would be 51,500 males and 48,500 females. The survivors at each age for these two groups may be determined by applying to the 51,500 males the survival rates ( $l_x$ ) of the life table for males and to the 48,500 females the survival rates of the life table for females. At each age of life the resulting number of surviving males and females is thus obtained and the sex ratio at each age may then be determined.

That procedure furnishes as a by-product all the elements necessary for the construction of what might be termed a "sex-adjusted life table." The addition at each age of life of the survivors among the males and among the females furnishes the number of survivors out of the original cohort of 100,000 infants born alive. That is the survivors column ( $l_x$ ) for a life table for 100,000 infants distributed by sex according to actual experience. From that column all the other functions of the life table may be obtained. The sex-adjusted life table, which in effect is a method of standardizing life tables for sex, may have a number of applications. For example, when the life-table functions are used as a basis for estimating the future population, they have to be standardized for sex.\* Again, if the life-table functions replace the crude death rate and birth rate as vital indexes of the population, there may be occasions when it would be desirable to have a single index for both sexes.<sup>4</sup>

\* Although he does not state it specifically, Karpinos (2) apparently used a sex-adjusted life table in his interesting paper on Stabilized Method of Forecasting Population. This can be seen from Table 1 of his paper where the age distribution of life-table population is given. (See age distribution for  $r=0.0$ ).

<sup>4</sup> Karpinos (2) gives such functions in Table 2.

In such considerations as change of the index over a period of time, comparisons between localities, correlations with sanitary and other factors, it may be simpler to deal with one index. The sex-adjusted life table would furnish the most logical way of combining the life tables for the two sexes, since it represents the age-sex distribution which results from the natural forces operating on the population and it more nearly corresponds to actual experience than any other combination of the two life tables.

It is the object of this paper to determine and discuss the sex distribution of the population at each age, which results from natality and mortality conditions operating on the population of the United States in 1930 and to construct a sex-adjusted life table.

#### THE RATIO OF THE SEXES AT EACH AGE

The ultimate sex distribution at each age resulting from the sex ratio at birth and the age-sex-specific mortality rates will first be determined for the white population in continental United States for the year 1930. During the three-year period 1929-1931, 51,423 per cent of all white live births were male. Consequently, of 100,000 infants born alive in 1930, it may be assumed that 51,423 were males and 48,577 females. These are the first figures entered in columns 2 and 5 of Appendix Table A. The remaining figures in column 2 of this table present the survivors of the 51,423 males at the beginning of each year of life. These were obtained by applying the survival rates ( $l_x$ ) as given by the Life Table of the Bureau of the Census. (3) Similarly in column 5 the number of survivors at the beginning of each year of age of the 48,577 females was obtained by applying the survival rates for females. From columns 2 and 5 all the other columns of the table were obtained. The remaining columns of the table have the following meanings:

Column 3 presents the number of males dying during each year of age ( $d_x$ ). Column 6 presents similar figures for females. The figures in column 4 represent the number of years lived by the

cohort of males in each year of age ( $L_x$ ), and column 7, corresponding figures for females. These last columns represent also the numbers of males and females alive during each year of age.

Comparison of columns 2 and 5 shows that there are more males than females at each year of life through age 50. Beginning with age 51 and continuing through the remainder of the life span, there are more females than males.

The masculinity rate<sup>5</sup> at each year of age is presented graphically in Figure 1 which shows the proportion of males alive during each year of life (column 4) out of the total survivors during the corresponding year of life (column 4 plus column 7).

It will be noted that the masculinity rates by age present a continuously decreasing curve. The rate starts at around 51.148 per cent during the first year of life and falls to as low as 36.364 per cent at age 100. The decrease is relatively small up to about age 36 at which age it becomes much more rapid. The curve intersects the 50 per cent line at age 50, indicating that there would be more males for each year of life up to that age and fewer males than females after that age.

The form of the curve is of considerable interest. Beginning with age 1 to about age 36, it is very nearly a straight line. From age 36 on it curves rapidly downward but in a very regular fashion. *A priori* one would expect a hump in the curve at the childbearing period, since it is during this period that the females are exposed to extra risks, and in fact, as will be seen later, such a hump does exist in the curve for Negroes and for whites during earlier periods. It is possible, however, that although a sharp decrease in the maternal mortality rate has not been noted until 1937, the improve-

<sup>5</sup> *Masculinity rate* is used in this paper to denote the ratio of males to the total population. The *sex-ratio*, as commonly used, denotes the number of males per 1,000 females. The former has many statistical advantages and will therefore be used in most cases. It was also thought more desirable to base the masculinity rates on  $L_x$  rather than on  $l_x$  because it is this figure that is more nearly comparable to census figures. The rates based on  $l_x$ , on the other hand, have the advantage that they are more clearly comparable to the usual masculinity rate "at birth."

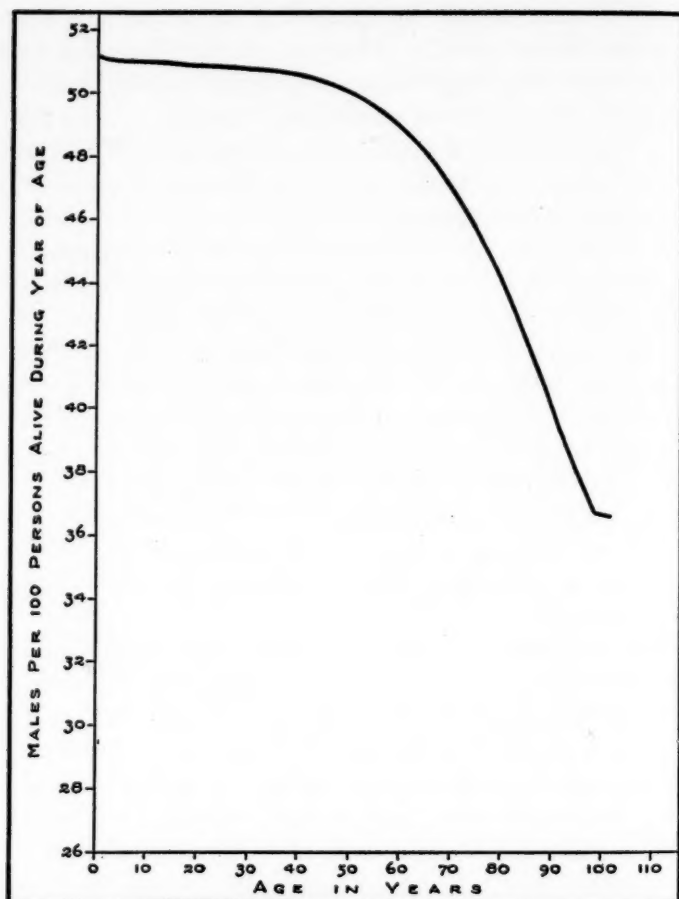


Fig. 1. Masculinity rate, by age, of survivors of 100,000 white infants, according to sex-adjusted life table: Continental United States, 1929-1931.

ment as reflected by the general mortality rate of mothers began much earlier. As a rough approximation, it appears from this curve that the extra hazard to which women are exposed during the most fertile period of their lives is counterbalanced by the extra risk

to which males are exposed as a result of their entrance into the occupationally active period. It may be tempting to try to estimate the extra risk which is due to childbearing on the basis of this curve. For example, it may be reasoned that, if it were not for that extra risk, the straight part of the masculinity curve would end not at age 36, as is shown in the figure, but at approximately age 20. Consequently an estimate of that risk may be obtained by drawing a parallel curve beginning at age 20. Although this method is obviously much too crude, it may nevertheless serve as a suggestive supplement to a more detailed and comprehensive study.

It is interesting to note the cumulative effect of the sexually selective mortality upon the distribution of the sexes. Although originally considerably more males than females entered the cohort, the higher death rates of the males at practically all ages not only resulted in the exhaustion of the numerical superiority of the males at birth but also was responsible for the fact that at the end of the life span there remain nearly two females for every male alive. In the ultimate population (stationary) resulting from the natality and mortality conditions existing in 1930 only 46 per cent of the persons aged 65 and over will be males, or there will be 117 females aged 65 and over for every 100 males of the same ages. Less than 48 per cent of the persons aged 50 and over will be male or there will be 109 females for every 100 males of these ages.

When the life span is divided into three main intervals in relation to the childbearing period the reduction in the masculinity rate is particularly noticed in the post-childbearing period. Thus, the masculinity rate for all persons under 15 years of age is 51.005, for persons 15-44 it is 50.736, and for all persons 45 years of age and over the masculinity rate is 48.341. For every 100 females in the corresponding age groups there are 104 males under 15, 103 males 15-44, and only 94 males 45 years of age and over.

The masculinity rate of the total population (all ages) will be very nearly 50 per cent (49.968 per cent). This fact is of some inter-

est because the total number of males and females of all ages (the accumulation of  $L_x$ ) also represents the total number of years of life lived by all the males and all the females entering into the original cohort. This number of years of life was found to be 3,040,145 for males and 3,044,085 for females. In other words, the aggregate of males will live nearly the same number of years as the aggregate of females.

MASCULINITY RATES BASED ON THE LIFE TABLES OF 1920  
AND OF 1930-1939

It would be desirable to follow the variation with time of the curve of masculinity rates by age, in order to determine whether, during a relatively long period of time, any radical changes in the form of the curve occur. Unfortunately the registration of births and deaths has not been complete during a long enough period in a sufficiently large number of States to make that possible, so that life tables for comparable groups of the population are not available. That some changes may have occurred with passage of time is indicated in Figure 2 which presents the curves of masculinity rates by age for the years 1919-1921 (Registration States of 1920) and for the period 1930-1939 based on the preliminary life tables for that period issued by the Bureau of the Census (4). It will be noted that although the general outlines (up to age 90)\* of these curves are very similar to those of the one for 1930 there are a number of differences between the curve for 1920 and those for 1930 and for 1930-1939. Most striking is the hump that appears in the curve for 1920 beginning shortly after age 20 and ending around age 45 (the childbearing period), whereas in the curves for 1930 and for 1930-1939 the straight line continues through age 36.

That the hump in the 1920 curve is probably due to a relatively high mortality of females aged 20-45, in that year, is substantiated

\* No great significance can be attached to the change in the outline of the 1920 curve which occurs after age 93. The rise at the end of this curve is probably a result of inaccurate registration and enumeration at the oldest ages.

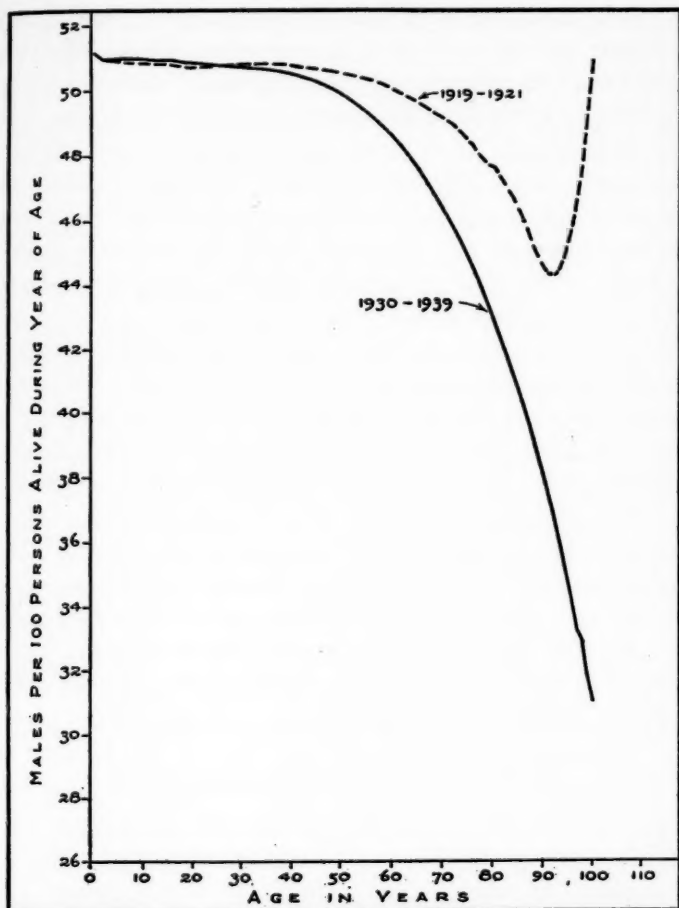


Fig. 2. Masculinity rate, by age, of survivors of 100,000 white infants, according to sex-adjusted life tables: Death Registration States of 1920 for 1919-1921 and Continental United States for 1930-1939.

by the findings of Wiehl (5). She shows that the reduction in the mortality between 1922 and 1934 was more rapid for females during the childbearing ages than for males of similar ages. In other

words, it will appear from these curves that although in the years following 1930 the extra risk to the female during the childbearing period was of a magnitude sufficient to balance the extra risk to the male, associated with his entrance into the occupationally active period; in 1920 the risk to the female during this age period was of a relatively larger magnitude. Another difference between the curves for 1920 and the subsequent curves is that in the former year the curve intersects the 50 per cent line after age 60 whereas in both the latter curves there are as many surviving males as females at age 50. This again is primarily due to the hump during the childbearing period. It is also of interest to note that toward the end of the life span the proportion of survivors who were males decreased continuously with the passage of time. Hence, of the survivors to age 90,<sup>7</sup> according to the 1920 life table, 44.659 per cent will be male, but the corresponding figure from the 1930 life table is 40.146, and from the 1930-1939 life table only 38.393. That fact is of interest and demonstrates that the difference between the mortality of males and females increased in the last two decades; in other words, in 1920 the mortality rate of the females was closer to that of the males than were the rates in 1940. This result agrees with that of Wiehl (5). It would be of interest to see whether this fanning out of the mortality rates of the two sexes continues in future years.

#### MASCULINITY RATES FOR NEGROES

Figure 3 presents, by age, the curve of the masculinity rate for Negroes for 1930. As is known, the sex ratio at birth for Negroes is considerably lower than that for whites. During the period 1929-1931 the Negro masculinity rate at birth was 50.818 compared to a rate of 51.423 for whites. It is primarily for that reason that the Negro masculinity rate curve intersects the 50 per cent line at age 36 as compared with age 50 for whites. It will be noted that the

<sup>7</sup> Age 90, rather than the oldest age in the life table, is used here because mortality rates by sex in the later years are not reliable.

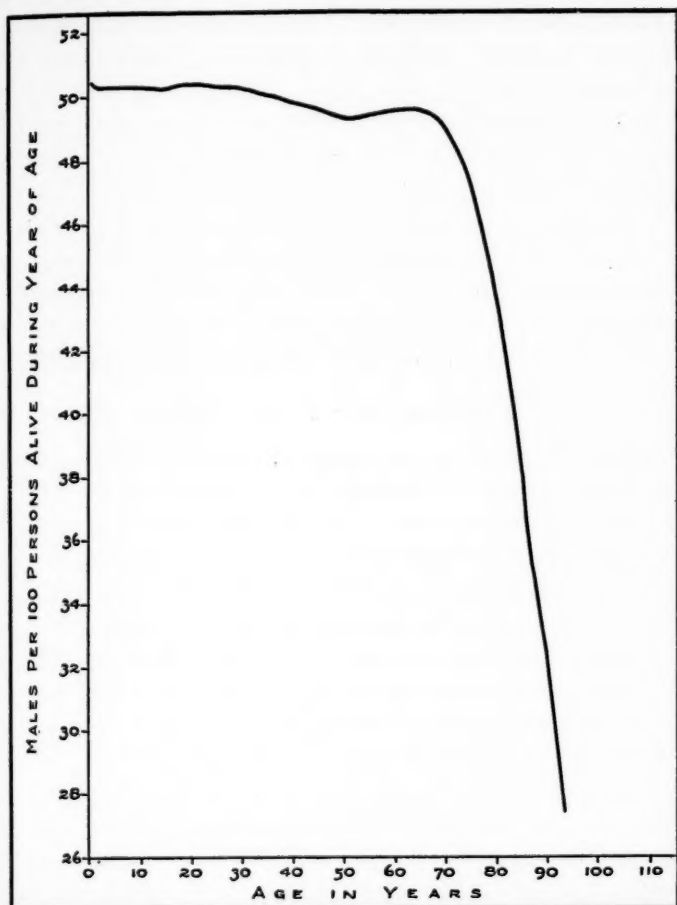


Fig. 3. Masculinity rate, by age, of survivors of 100,000 Negro infants, according to sex-adjusted life table: Continental United States, 1929-1931.

curve for Negroes is not as regular nor does it fall as rapidly (up to age 70) as that for the whites.

The curve for Negroes exhibits two humps—one beginning at age 15 and ending at age 30 which is probably due to the relatively

high extra risk associated with childbearing among Negro women. The other hump, which begins after age 50 and ends around age 70, may not be explained easily. It may be due to faulty registration of deaths or unreliable population figures. In fact, the curve for Negroes based on the 1920 life table (for the Registration States of 1920) is most irregular. It rises continuously beginning with age 3 to a maximum masculinity rate of 53.445 at age 71. It is very unlikely that such a situation actually existed since it would indicate that throughout life the mortality among the females was very much higher than that among the males. It is more probable that the life table for Negroes for 1920 was deficient in many respects.

#### THE RELATIVE MORTALITY OF THE SEXES

Starting with a given masculinity rate at birth the form of the masculinity curve by age depends entirely on the ratio of the mortality rates of the two sexes at each age. This ratio is not constant throughout life but exhibits a triple peak curve, as may be seen from Figure 4, which presents the ratio of the life-table mortality rates of white males to those of white females by age for 1930.

The first peak is in the first year of life, the second around puberty, and the third at middle age. In the first year of life the mortality of males is more than 25 per cent higher than that of females. The ratio of the mortality rate among males to that among females decreases sharply and at age 3 the mortality among boys is only 10 per cent higher than that among girls. Beginning at age 4 the ratio increases sharply up to age 12, when the mortality among males is higher than that among females by one-third, but a sharp decrease brings the ratio again to low levels at the ages of 20 to 30. Between the ages of 30 and 50 the ratios increase to a peak around age 50 and thereafter decrease. It is noteworthy that the curve remains above the 1.00 mark to age 100. In other words, at all ages up to the end of the life span the mortality among the males is higher than that among the females.

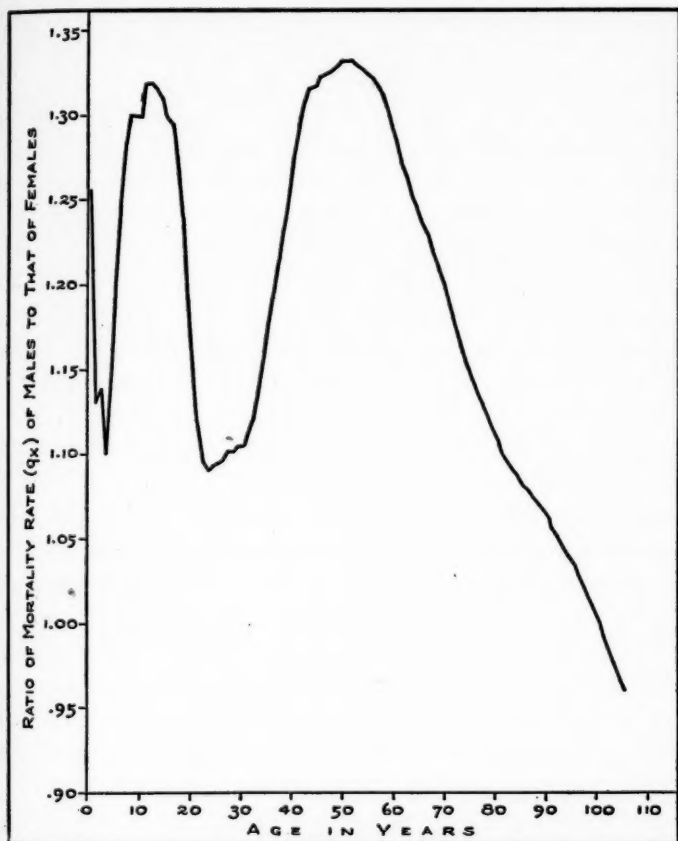


Fig. 4. Ratio of life table mortality rate ( $q_x$ ) of white males to that of white females at each year of age: Continental United States, 1929-1931.

#### MASCULINITY RATES OF THE ENUMERATED POPULATION

The curves of masculinity rates by age described above may be considered theoretical, in the sense that they represent the ratio of the sexes in a theoretical population resulting from mortality conditions which were operating in one specific year. The various age

groups comprising any actual population were subjected throughout their previous lives to constantly changing mortality rates. Consequently, the age-sex composition of any actual population could not be expected to be identical with that of the theoretical population. Moreover, when the population of a given country is considered, the eventual sex composition at each age may also be greatly influenced by emigration and immigration since there is a sex differential in both. It should, however, be possible to eliminate the factor of migration by considering only the native population. In this country where emigration throughout the years has been of negligible proportions, the age-sex composition of the native population is affected only by the natural processes of birth and death. Although this population has been subjected in previous years to changing mortality rates it may nevertheless be expected that, at least in general form, its age-sex composition should not differ greatly from that described by the theoretical curves, since the higher mortality rate among the males is not a new phenomenon but appears in all recorded vital statistics. In fact, the curves of masculinity rates by age based on "generation" life tables are similar in form to those based on ordinary life tables. "Generation" life tables have recently been constructed by Dublin and Spiegelman (6). In these tables a generation of people born in a given year is traced on the basis of the mortality actually experienced from birth until 1930-1932, and on the basis of the 1930-1932 mortality rates until the entire group is accounted for by death. These life tables, therefore, attempt to reconstruct the previous vital history of a large part of the present population.

Dublin and Spiegelman have constructed "generation" life tables for England and Wales for various time periods beginning with 1876, for Massachusetts beginning with 1890, and for the white population of the original Death Registration States beginning with 1901. From these tables it was possible to construct curves of masculinity rates by age based on "generation" life tables and on life tables

which were current at the year of birth of the generation. It was found that in every case the forms of the curves were similar except that the curves based on "generation" life tables were generally steeper than those based on current life tables. This is in agreement with the observation made above that the mortality rates among the females were closer to those among the males in the past than they are today.

Allowing, therefore, for occasional fluctuations, the age-sex composition of the enumerated native population should be similar to that of the theoretical population described above. Actually, masculinity rates obtained from census figures differ markedly from the theoretical curves, as may be seen from Table 1 and Figure 5, which

Table 1. Sex distribution and masculinity rates of the enumerated native-white population by five-year age periods: Continental United States, 1930.

AGE IN YEARS	TOTAL	MALE	FEMALE	MASCULINITY RATE <sup>1</sup>
TOTAL	95,497,800	48,010,145	47,487,655	50.274
Under 1	1,895,302	965,226	930,076	50.927
1-4	8,004,306	4,071,763	3,932,543	50.870
5-9	10,834,453	5,497,255	5,337,198	50.739
10-14	10,398,546	5,265,795	5,132,751	50.640
15-19	9,786,954	4,907,316	4,879,638	50.141
20-24	8,804,163	4,346,913	4,457,250	49.373
25-29	7,552,690	3,731,794	3,820,896	49.410
30-34	6,862,936	3,408,584	3,454,352	49.667
35-39	6,551,953	3,278,767	3,273,186	50.043
40-44	5,504,331	2,771,481	2,732,850	50.351
45-49	4,757,775	2,411,909	2,345,866	50.694
50-54	4,091,686	2,092,785	1,998,901	51.147
55-59	3,264,494	1,670,570	1,593,924	51.174
60-64	2,566,416	1,305,260	1,261,156	50.859
65-69	1,882,526	944,823	937,703	50.189
70-74	1,377,436	690,036	687,400	50.096
75-79	770,082	376,565	393,517	48.899
80-84	355,911	165,846	190,065	46.598
85-89	131,839	57,036	74,803	43.162
90-94	30,499	11,720	18,779	38.427
95 and Over	5,997	2,212	3,785	36.885
Not Stated	67,505	36,489	31,016	54.054

<sup>1</sup> Males per 100 persons.

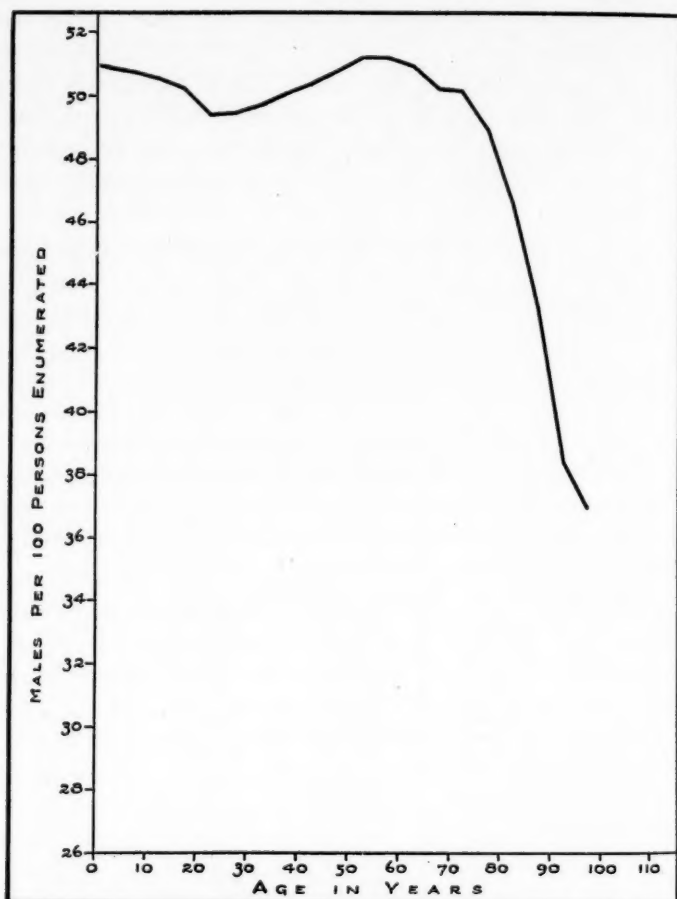


Fig. 5. Masculinity rate of the enumerated native-white population, by five-year age periods: Continental United States, 1930.

present masculinity rates in five-year age groups for the native white population of the United States as enumerated in the 1930 census.

The masculinity rate of the enumerated population starts with

50.927 for the first year of life, decreases sharply thereafter, and intersects the 50 per cent line at age 18. It falls to a low point of 49.373 at ages 20-24 and then rises, intersecting the 50 per cent line again at age 36. It continues to rise to a peak of 51.174 at ages 55-59 and from that point it falls abruptly to a low value of 36.339 at ages 95-99.

It is the relatively large jump of the masculinity rate at middle age which is difficult to explain; particularly since it rises even above the masculinity rate at birth. It is very unlikely that this curve portrays accurately the age-sex composition of the actual population. Two possible factors may have produced a population with the age-sex composition as given by the census figures. Either the ratios of the sexes at birth in previous years were very much higher than at present or the mortality rates among the females were in the past higher than those among the males. This higher mortality among the females may have operated either through a relatively long period of time or it may have been a phenomenon lasting a short period of time, such as a widespread epidemic which attacked the females more seriously than the males. The known facts do not support either of these above two hypotheses. The variations in the sex ratio at birth are at most very slight and do not indicate that it was very much higher 50 or 60 years ago than at present. As to the differential mortality by sex, it is true that in previous years the differences between the mortality rates among males and females were smaller than they are today. However, the "generation" life tables of Dublin and Spiegelman (6) show clearly that a difference in mortality between the two sexes did exist and this difference was always in favor of the females. The influenza epidemic of 1918, which is the only major catastrophe in this country that should be considered in this connection, was not selective for females and consequently could not have produced this increase in the proportion of middle-aged males.

A further indication that the age-sex composition of the actual

population is not accurately portrayed by the census figures is obtained from the distribution of the masculinity rates by age of the deaths occurring in the actual population. For, if the age-sex composition of the native population is really different from that of the theoretical population, it would be reasonable to expect a similar difference in the deaths of the two populations. However Figure 6, which presents the masculinity rates by five-year age groups of the actual deaths of the native-white population in 1930 and corresponding figures for the theoretical population, shows that they are similar in form. Both curves are triple-peaked, with the peaks occurring at practically the same ages. The actual values of the masculinity rates are also sufficiently close for the two curves to suggest that the distribution of the sexes in the populations in which these deaths occurred could not be so different as was found.

It may therefore be concluded that although natality and mortality conditions existing in the past may have had some influence in producing an age-sex distribution of the enumerated population which is different from that of the theoretical population, this influence is slight and a complete explanation of the form of the actual curve lies in other extraneous factors. These factors probably are related to faulty enumeration and may comprise any one or a combination of the following three: (a) Inaccuracies in the statement of nativity, that is, it is possible that there is a sex difference in the accuracy of statement of nativity; (b) sex differences in the completeness of enumeration at various ages; or (c) sex differences in the misstatement of age at enumeration.

Smith and Hitt (7) believe that the entire difference between the actual and theoretical curves is due to misstatement of women's ages. In fact, they use the deviation in the masculinity rates between the observed and the theoretical curves as a means of estimating at each age period the proportion of women who presumably misstated their ages. However, it seems very unlikely that misstatement of women's ages is responsible for the entire distortion, or even for

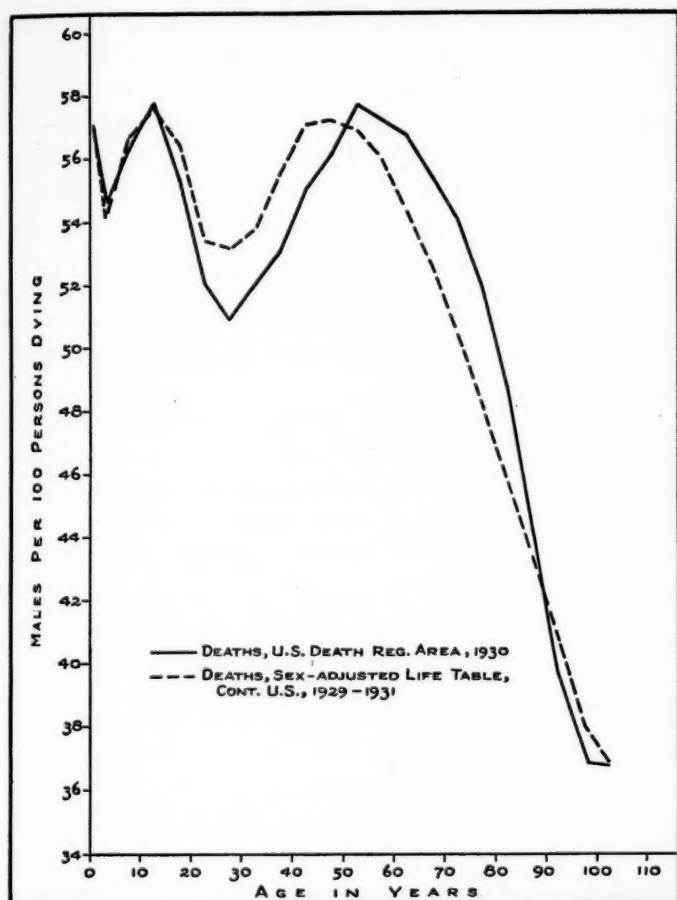


Fig. 6. Masculinity rate, by five-year age periods of native-white persons who died. Actual—United States death registration area, 1930. Theoretical—according to sex-adjusted life table: Continental United States, 1929-1931.

the major part of the distortion, in the curve of masculinity rates by age. In the first place, a considerable amount of the error introduced by misstatement of age is of a compensatory nature. In other

words, although it is true that the enumerated female population of age A is deficient because a certain number of them who should be in this age group are counted in lower age groups, this error will be compensated for, in a large measure, by a number of women who were enumerated as of age A but actually belong in higher age groups. If the explanation of Smith and Hitt is to be accepted, there must be in the population a large number of women around age 50 who are recorded as under 30. Moreover, even if the entire distortion of the curve is due to misstatement of age, the method used by Smith and Hitt to estimate the proportion of women who misstated their ages can be accepted only if the theoretical curve is based on a "generation" life table.

The most serious defect in the method, however, is the assumption that misstatement of age is limited entirely to females and that males do not engage in large-scale misstatement of age. Smith and Hitt conclude that such is the case from the fact that when the numbers of native males and females aged 5-9, 10-14, and 15-19 in 1920 are compared with the numbers aged 15-19, 20-24, and 25-29 in 1930, "... the decrease experienced by the female groups during this period was insignificant relative to that occurring among the corresponding males."<sup>8</sup> However, a continuation of this process for older age groups reveals a relatively large distortion among the males as well. For example, when the number of native males aged 25-29 in 1920 is compared with the number of native males aged 35-39 in 1930, there is a decrease of only 0.7 per cent in the ten-year period, whereas the decrease for the younger age group (ages 20-24 in 1920 and 30-34 in 1930) is 4.3 per cent. Furthermore, there is direct evidence that males are as likely to misstate their ages as are females. Densen, in a study on the accuracy of statements of age on census records, traced over 25,000 individuals in two censuses and nearly 3,000 individuals through three censuses. He studied the errors in the reporting of age by relating the reported

<sup>8</sup> *Op. cit.*, p. 101.

age of an individual at one census to the same individual's age as reported at a later census. He concludes that "Even when broken down by age, the distributions of differences for males and females fail to show any consistent divergence from each other." (8; p. 18). It appears, therefore, that while misstatement of ages unquestionably plays a part in producing the unnatural form of the masculinity curve of the actual population, it is probably not the only factor.

To what extent other factors such as the misstatement of nativity or the sex differential in underenumeration at different age levels contribute to the distortion of the age-sex composition of the enumerated population would be difficult to measure. In the case of nativity an attempt was made to eliminate that factor by considering only the native population of native parentage. It was found, however, that, in this case as well, there is a considerable increase in the masculinity rate at the middle ages. The entire problem must be left to students of enumeration who may have opportunities for more direct investigations. Suffice it here to state that the problem is of considerable importance, primarily in its effects on such vital indexes as fertility and mortality rates.

#### THE SEX-ADJUSTED LIFE TABLE

The use of the crude death rate as a vital index of the population is becoming increasingly undesirable and misleading. The population of the United States, as is known, is aging and it may be expected that before long the crude death rate will begin to rise even if the death rates at each age continue to decline. It is therefore important to find a satisfactory substitute for the crude death rate. The tendency in the last few years has been to employ the life-table functions as the most natural vital indexes of the health of the population. With the recent development by Reed and Merrell (9) of a relatively easy method for constructing abridged life tables it may be expected that health departments will begin to use the life-table functions more effectively.

The transition from the use of crude death rates to that of life-

table functions presents the difficulty that the crude death rate in the past has been used as a single index for the two sexes, while life tables are always constructed specific for sex. This separation of the life-table functions by sex has unquestionable merit because of the large differences in the mortality experiences of the two sexes, and it is not implied here that it should be discontinued. There may, however, be occasions when it would be desirable to use, in addition to the sex-specific life tables, a table which combines the experiences of the two sexes. This may particularly be the case in the period of transition from the crude death rate to the life table since the public has become familiar with the use of a single index. If such a combined life table (for the two sexes) should be found to be useful it would appear that the most natural method of standardizing the life tables for sex is to use the sex-adjusted life tables as described above. Such a life table would then have the following meaning: Starting with 100,000 infants born alive and distributed by sex according to actual experience (that is, according to the known sex ratio at birth), the number of survivors among the males and among the females are determined from the respective sex-specific life tables. Consequently, survivors among the original cohort at each age period as well as all the other life-table functions may be determined. The construction of sex-adjusted life tables, when the sex-specific life tables are known, is relatively simple.

A sex-adjusted life table based on the natality and mortality conditions operating on the white population of the United States in 1930 is presented in Appendix Table B. Column 2 gives the number of survivors of the original cohort to each year of age and was obtained by adding columns 2 and 5 of Appendix Table A. This column is sufficient for the construction of all the remaining columns. Thus, column 3, which gives the number dying during each year of age is obtained by subtracting the consecutive corresponding figures in column 2. The remaining columns are obtained from columns 2 and 3 by the usual method.

## SUMMARY

The purpose of this paper is to present for each year of age the distribution of the sexes, which results from the ratio of the sexes at birth and the age-sex-specific mortality rates. The masculinity rates by age for the white population based on 1930 life tables follow a continuously decreasing smooth curve which is linear up to age 36, and curves downward beginning with that age. In the ultimate population there will be more males than females up to age 50, and more females than males after that age. At the end of the life span there would be nearly two females for every male alive. The curves of masculinity rates by age based on the 1920 and 1930-1939 life tables as well as for Negroes for 1930 are presented. The masculinity curve of the enumerated population is contrasted with theoretical curves and the difference between the two is discussed. A method of standardizing life-table functions for sex is presented in the form of a sex-adjusted life table.

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Appendix Table A. Male and female survivors, at each year of age, of 100,000 white births, distributed by sex according to the sex-ratio at birth, 1929-1931, subject to the life table survival rates: Continental United States, 1929-1931.

YEAR OF AGE	MALES			FEMALES		
	Of 51,423 Males Born Alive			Of 48,577 Females Born Alive		
	Number Alive at Be- ginning of Year of Age	Number Dying During Year of Age	Number Alive During Year of Age	Number Alive at Be- ginning of Year of Age	Number Dying During Year of Age	Number Alive During Year of Age
x to x + 1	$l_x$	$d_x$	$L_x$	$l_x$	$d_x$	$L_x$
1	2	3	4	5	6	7
0- 1	51,423	3,205	48,884	48,577	2,411	46,689
1- 2	48,218	478	47,936	46,166	405	45,926
2- 3	47,740	249	47,608	45,761	209	45,650
3- 4	47,491	170	47,403	45,552	149	45,475
4- 5	47,321	147	47,245	45,403	121	45,340
5- 6	47,174	125	47,112	45,282	100	45,232
6- 7	47,049	106	46,996	45,182	83	45,140
7- 8	46,943	93	46,897	45,099	69	45,064
8- 9	46,850	80	46,810	45,030	59	45,000
9- 10	46,770	73	46,734	44,971	54	44,944
10- 11	46,697	68	46,663	44,917	51	44,891
11- 12	46,629	70	46,594	44,866	50	44,841
12- 13	46,559	73	46,523	44,816	54	44,789
13- 14	46,486	79	46,447	44,762	58	44,733
14- 15	46,407	88	46,363	44,704	65	44,671
15- 16	46,319	98	46,270	44,639	73	44,602
16- 17	46,221	112	46,165	44,566	83	44,525
17- 18	46,109	123	46,047	44,483	92	44,437
18- 19	45,986	131	45,920	44,391	103	44,340
19- 20	45,855	138	45,786	44,288	113	44,232
20- 21	45,717	145	45,644	44,175	122	44,114
21- 22	45,572	154	45,495	44,053	133	43,987
22- 23	45,418	161	45,337	43,920	141	43,850
23- 24	45,257	163	45,176	43,779	145	43,706
24- 25	45,094	165	45,011	43,634	146	43,561
25- 26	44,929	167	44,846	43,488	147	43,414
26- 27	44,762	167	44,679	43,341	148	43,267
27- 28	44,595	171	44,510	43,193	150	43,118
28- 29	44,424	173	44,337	43,043	152	42,967
29- 30	44,251	178	44,162	42,891	157	42,812
30- 31	44,073	182	43,982	42,734	159	42,654
31- 32	43,891	187	43,797	42,575	163	42,494
32- 33	43,704	193	43,608	42,412	167	42,328
33- 34	43,511	202	43,410	42,245	172	42,159
34- 35	43,309	210	43,204	42,073	176	41,985

# The Age-Sex Composition of the Population

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Appendix Table A. (Continued)

YEAR OF AGE	MALES			FEMALES		
	Of 51,423 Males Born Alive			Of 48,577 Females Born Alive		
	Number Alive at Be- ginning of Year of Age	Number Dying During Year of Age	Number Alive During Year of Age	Number Alive at Be- ginning of Year of Age	Number Dying During Year of Age	Number Alive During Year of Age
x to x + 1	l <sub>x</sub>	d <sub>x</sub>	L <sub>x</sub>	l <sub>x</sub>	d <sub>x</sub>	L <sub>x</sub>
1	2	3	4	5	6	7
35- 36	43,099	220	42,989	41,897	182	41,806
36- 37	42,879	230	42,764	41,715	186	41,622
37- 38	42,649	240	42,529	41,529	192	41,433
38- 39	42,409	253	42,283	41,337	200	41,237
39- 40	42,156	268	42,022	41,137	208	41,033
40- 41	41,888	285	41,746	40,929	218	40,820
41- 42	41,603	302	41,452	40,711	228	40,597
42- 43	41,301	320	41,141	40,483	240	40,363
43- 44	40,981	338	40,812	40,243	252	40,117
44- 45	40,643	356	40,465	39,991	265	39,859
45- 46	40,287	374	40,100	39,726	279	39,586
46- 47	39,913	394	39,716	39,447	294	39,300
47- 48	39,519	416	39,311	39,153	311	38,997
48- 49	39,103	439	38,884	38,842	328	38,678
49- 50	38,664	463	38,433	38,514	346	38,341
50- 51	38,201	488	37,957	38,168	366	37,985
51- 52	37,713	515	37,456	37,802	388	37,608
52- 53	37,198	543	36,927	37,414	410	37,209
53- 54	36,655	574	36,368	37,004	436	36,786
54- 55	36,081	609	35,776	36,568	465	36,336
55- 56	35,472	645	35,150	36,103	497	35,854
56- 57	34,827	685	34,485	35,606	530	35,341
57- 58	34,142	725	33,780	35,076	568	34,792
58- 59	33,417	765	33,035	34,508	606	34,205
59- 60	32,652	804	32,250	33,902	645	33,580
60- 61	31,848	842	31,427	33,257	686	32,914
61- 62	31,006	880	30,566	32,571	727	32,208
62- 63	30,126	919	29,666	31,844	771	31,459
63- 64	29,207	963	28,726	31,073	817	30,664
64- 65	28,244	1,008	27,740	30,256	867	29,822
65- 66	27,236	1,053	26,710	29,389	919	28,929
66- 67	26,183	1,098	25,634	28,470	973	27,984
67- 68	25,085	1,144	24,513	27,497	1,027	26,983
68- 69	23,941	1,185	23,349	26,470	1,082	25,929
69- 70	22,756	1,220	22,146	25,388	1,133	24,822

Appendix Table A. (Continued)

YEAR OF AGE	MALES			FEMALES		
	Of 51,423 Males Born Alive			Of 48,577 Females Born Alive		
	Number Alive at Be- ginning of Year of Age	Number Dying During Year of Age	Number Alive During Year of Age	Number Alive at Be- ginning of Year of Age	Number Dying During Year of Age	Number Alive During Year of Age
x to x + 1	$l_x$	$d_x$	$L_x$	$l_x$	$d_x$	$L_x$
1	2	3	4	5	6	7
70-71	21,536	1,248	20,912	24,255	1,180	23,665
71-72	20,288	1,269	19,654	23,075	1,222	22,464
72-73	19,019	1,282	18,378	21,853	1,259	21,224
73-74	17,737	1,289	17,093	20,594	1,290	19,949
74-75	16,448	1,293	15,802	19,304	1,319	18,644
75-76	15,155	1,292	14,509	17,985	1,342	17,314
76-77	13,863	1,286	13,220	16,643	1,359	15,964
77-78	12,577	1,271	11,942	15,284	1,369	14,599
78-79	11,306	1,245	10,684	13,915	1,367	13,231
79-80	10,061	1,205	9,459	12,548	1,350	11,873
80-81	8,856	1,151	8,281	11,198	1,314	10,541
81-82	7,705	1,082	7,164	9,884	1,262	9,253
82-83	6,623	1,001	6,122	8,622	1,192	8,026
83-84	5,622	912	5,166	7,430	1,106	6,877
84-85	4,710	816	4,302	6,324	1,011	5,818
85-86	3,894	720	3,534	5,313	908	4,859
86-87	3,174	622	2,863	4,405	802	4,004
87-88	2,552	531	2,286	3,603	697	3,255
88-89	2,021	443	1,800	2,906	597	2,607
89-90	1,578	366	1,395	2,309	502	2,058
90-91	1,212	298	1,063	1,807	419	1,597
91-92	914	238	795	1,388	342	1,217
92-93	676	186	583	1,046	275	909
93-94	490	144	418	771	217	662
94-95	346	109	292	554	167	470
95-96	237	79	198	387	125	324
96-97	158	57	130	262	91	216
97-98	101	38	82	171	64	139
98-99	63	26	50	107	43	86
99-100	37	16	29	64	28	50
100-101	21	10	16	36	17	28
101-102	11	5	8	19	10	14
102-103	6	3	4	9	5	7
103-104	3	2	2	4	2	3
104-105	1	1	1	2	2	1

Appendix Table B. Sex-adjusted life table for the white population: Continental United States, 1929-1931.

YEAR OF AGE	OF 100,000 INFANTS BORN ALIVE		MORTALITY RATE	TOTAL NUMBER OF YEARS LIVED BY EACH GENERATION OF 100,000 INFANTS		COMPLETE EXPECTATION OF LIFE
	Number Alive at Beginning of Year of Age	Number Dying During Year of Age	Number Dying per 1,000 Alive at Beginning of Year	In Year of Age	In Year of Age and all Later Years	Average Number of Years Remaining at Beginning of Year of Age
x to x+1	$l_x$	$d_x$	$1,000q_x$	$L_x$	$T_x$	$e_x$
1	2	3	4	5	6	7
0-1	100,000	5,616	56.16	95,573	6,084,230	60.84
1-2	94,384	883	9.36	93,862	5,988,657	63.45
2-3	93,501	458	4.90	93,258	5,894,795	63.05
3-4	93,043	319	3.43	92,878	5,801,537	62.35
4-5	92,724	268	2.89	92,585	5,708,659	61.57
5-6	92,456	225	2.43	92,344	5,616,074	60.74
6-7	92,231	189	2.05	92,136	5,523,730	59.89
7-8	92,042	162	1.76	91,961	5,431,594	59.01
8-9	91,880	139	1.51	91,810	5,339,633	58.12
9-10	91,741	127	1.38	91,678	5,247,823	57.20
10-11	91,614	119	1.30	91,554	5,156,145	56.28
11-12	91,495	120	1.31	91,435	5,064,591	55.35
12-13	91,375	127	1.39	91,312	4,973,156	54.43
13-14	91,248	137	1.50	91,180	4,881,844	53.50
14-15	91,111	153	1.68	91,034	4,790,664	52.58
15-16	90,958	171	1.88	90,872	4,699,630	51.67
16-17	90,787	195	2.15	90,690	4,608,758	50.76
17-18	90,592	215	2.37	90,484	4,518,068	49.87
18-19	90,377	234	2.59	90,260	4,427,584	48.99
19-20	90,143	251	2.78	90,018	4,337,324	48.12
20-21	89,892	267	2.97	89,758	4,247,306	47.25
25-26	88,417	314	3.55	88,260	3,801,425	42.99
30-31	86,807	341	3.93	86,636	3,363,313	38.74
35-36	84,996	402	4.73	84,795	2,933,692	34.52
40-41	82,817	503	6.07	82,566	2,513,974	30.36
45-46	80,013	653	8.16	79,686	2,106,602	26.33
50-51	76,369	854	11.18	75,942	1,715,256	22.46
55-56	71,575	1,142	15.96	71,004	1,344,848	18.79
60-61	65,105	1,528	23.47	64,341	1,002,376	15.40
65-66	56,625	1,972	34.83	55,639	697,184	12.31
70-71	45,791	2,428	53.02	44,577	440,185	9.61
75-76	33,140	2,634	79.48	31,823	242,400	7.31
80-81	20,054	2,465	122.92	18,822	109,605	5.47
85-86	9,207	1,628	176.82	8,393	38,955	4.13
90-91	3,019	717	237.50	2,660	9,394	3.11
95-96	624	204	326.92	522	1,388	2.22
100-101	57	27	473.68	44	84	1.47

## THE COST OF TUBERCULOSIS CONTROL IN THE DEPARTMENT OF HEALTH, NEW YORK CITY, 1940

H. R. EDWARDS, M.D., F.A.C.P.<sup>1</sup>

RECENTLY a report was published on the economics of mass examination for tuberculosis (1) in which an attempt was made to set up indices of such costs that would be fairly constant for specified operations of such services. That study dealt with the mass surveys of the Department of Health for the period January 1 to June 30, 1940.

At that time it was decided to set up a continuing study for the surveys of the latter half of 1940 and also to collect all available data on the cost of operation of all tuberculosis services of the Department of Health. This report will, therefore, deal with the complete costs of tuberculosis control in the Department of Health insofar as exact costs were known and such other costs as could be reasonably estimated. In the analysis of mass survey costs for the entire year, certain recalculations were found necessary for the data reported in the first half of the year.

### MASS SURVEYS

The mass survey program was conducted along the same lines as previously reported. (1) The reallocation of those costs by period and for the entire year are shown in Table 1.

The total number of individuals surveyed in the first half of the year was 24,082, in the last half 67,257, or a total of 91,339 for the entire year. The average cost of \$1.71 per person surveyed in the first half of the year was considerably higher than the cost, \$1.09 per person, for the second half of the year. The personnel and other costs formed a higher proportion of the total expenditure in the first

<sup>1</sup> Director, Bureau of Tuberculosis, Department of Health, New York City.

TYPE OF EXPENDITURE	JANUARY-JUNE	JULY-DECEMBER	JANUARY-DECEMBER
TOTAL COST	\$41,198.80	\$73,511.47	\$114,710.27
I Original Mass Survey Using Roll Paper	18,096.65	48,470.96	66,567.61
II Personnel and Other Costs Required to Complete Surveys	23,102.15	25,040.51	48,142.66
Per Cent of Cost			
I	43.93	65.94	58.03
II	56.07	34.06	41.97

Table 1. Cost of x-ray surveys in 1940.

half of the year when only about one-fourth of the total examinations were made.

The average cost for each original survey film in the first half of the year was 75.1 cents, the last half of the year 72.6 cents, and for the entire year 72.8 cents. It should be pointed out that these unit costs represent a service item in which the vendor provided the equipment and personnel to process the film so that they were delivered to us ready for interpretation. There are no figures available showing the vendor's cost of x-ray film and service separately, so a more accurate unit cost on the basis of film only is not possible. The Department of Health purchases 14 x 17 paper in gross lots at as low as 16 cents per sheet. When this amount is considered in relation to the total cost, it is evident that the film is a small part of the total service charges. These facts should be taken into account by those using other methods in which the film cost is usually mentioned as the cost of the survey. If the equipment is owned and operated by an agency, there will be costs for overhead, depreciation, tube replacement, and personnel which must be added to the total cost of a survey.

It was possible to handle the much greater number of persons in the latter half of the year because groups, in which there was a

relatively low prevalence of tuberculosis, formed a high proportion of the total surveyed. For example, there were 40,120 students from vocational high schools included. The prevalence of cases of chronic pulmonary tuberculosis in this group was only 0.29 per cent and, therefore, the number of individuals to be restudied was low. Also, it is possible to read films of low prevalence groups with great rapidity. It is estimated that with the personnel available in 1940 a total of 100,000 persons could have been handled conveniently if they were evenly spread over the year.

### UNIT COSTS OF SURVEYS

The data for complete surveys in 1940 as shown in Table 2 are not typical of the average surveys usually done by this Department. They are heavily weighted by the vocational high school students

Table 2. Classification of 91,339 individuals surveyed in 1940 showing total cost per group and unit costs according to diagnosis.

CLASSIFICATION	NUMBER X-RAYED	AVERAGE AGE	NUMBER DIAG- NOSED CHRONIC PULMONARY TUBERCULOSIS		TOTAL COST AT \$1.2527 PER PERSON	UNIT COSTS	
			Active <sup>1</sup>	Active & Arrested		Chronic Pulmonary Tuberculosis	
						Active <sup>1</sup>	Active & Arrested
Junior High Schools <sup>1</sup>	2,573	14.6	23	27	\$3,223.20	\$140.14	\$119.38
Vocational High Schools	47,792	16.5	105	144	59,869.04	570.18	415.76
Academic High Schools	184	18.0	1	2	230.50	230.50	115.25
Colleges	462	19.3	4	4	578.75	144.69	144.69
National Youth Administration	5,572	20.8	44	76	6,980.04	158.64	91.84
Draftees	2,984	25.7	17	39	3,738.06	219.88	95.84
National Guardsmen	362	26.0	8	12	453.48	56.68	37.79
Evening High Schools	925	29.1	3	12	1,158.75	386.25	96.56
Settlement Homes	6,883	31.7	28	170	8,622.33	307.94	50.72
Housing Projects	4,086	33.3	18	103	5,118.53	284.36	49.69
Civil Service Employees	2,057	33.4	1	19	2,576.80	2,576.80	135.62
Unions	8,699	36.8	60	366	10,897.24	181.62	29.77
Department of Correction	6,202	37.6	213	435	7,769.25	36.47	17.86
WPA Teachers	451	37.8	4	25	564.97	141.24	22.60
Department of Welfare	2,107	50.8	80	209	2,639.44	32.99	12.63

<sup>1</sup> Tuberculin tested.

<sup>2</sup> Clinically significant.

of low yield and, therefore, result in a higher average cost than is usual.

It is immediately obvious from Table 2 that as a rule the lowest unit costs for finding a case of chronic pulmonary tuberculosis are to be found among those whose average age is above 20 years, excepting Civil Service employees and the students in junior high schools. The lowest cost for significant cases was found among persons from the lower income levels, such as prisoners and those on relief.

The average age of Civil Service employees was 33.4 years and the unit cost of a case of chronic pulmonary tuberculosis was \$135.62. The unit cost of a significant case was \$2,576.80, the highest of any group in this study. Among them there was only one significant case and eighteen classified as arrested. This is in line with most of our studies in which the percentage of persons with arrested lesions usually increases with age.

The relatively low yield of tuberculosis in the examination of Civil Service employees is readily accounted for by the fact that routine chest x-rays have been required as a part of the examination for applicants for employment in the Health, Education, and Fire Departments for the past five years. An analysis of this material on a yearly basis during these studies has shown a steadily declining prevalence of tuberculosis. In a number of instances, it is known that applicants, either as a routine matter, or because of doubt about their ability to pass the physical requirements, have secured chest x-rays before making applications for positions. If a lesion is found, they do not apply, or, as frequently happens, seek our advice as to whether or not they will be acceptable.

It is of interest to point out that the foregoing reaction on the part of the applicants has been responsible for many persons seeking the advice of the family physician who probably would not have done so otherwise. Where lesions have been demonstrated by our clinic staff it has been found that those applicants go immediately to their

physicians for further advice. Thus far there has been a cordial relationship and understanding between the Department and these physicians on the handling of such cases.

The students reported here from junior high schools were preselected for paper x-ray on the basis of a tuberculin test. This group with an average age of 14.6 years showed a unit cost per case of chronic pulmonary tuberculosis of \$119.38, and \$140.14 for a significant case. These unit costs are considerably less than the unit costs among the students in vocational high schools even though the latter were of a higher age level. This condition is predominantly a reflection of the preselection factor in tuberculin testing. The students of both of these groups represent individuals from low-income levels and a substantial proportion of the junior high school pupils were colored.

On the basis of these findings, the program among vocational high school students was changed. In the new program only those schools were selected for survey that had a prevalence of disease equal to or greater than the average prevalence found in the study reported here. In the new program the students are to be tuberculin patch tested and x-rays provided for positive reactors. This program is now in effect but is not as successful in securing cooperation as the straight x-ray plan for two reasons: first, because the students dislike the patch test; secondly, the school officials have not been as keen about the new plan because it requires additional operations, applying patches and interpreting results and, therefore, means further interruption of the school routine. Undoubtedly this lack of enthusiasm is in large part due to the greatly accelerated program in these institutions as a result of the war effort. There can be no question of the desirability of such a program at this time when these students are going into war industries at such an early age.

#### EXPENDITURES FOR TUBERCULOSIS CONTROL

The data presented here relate only to the expenditures made by

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the Department of Health and those funds available for tuberculosis work through WPA. There are four additional official district clinic services under the control of the Department of Hospitals, and two under the control of private hospitals in addition to the twenty-three clinics operated by the Department of Health. Also there are ten other clinics, not official, that admitted and supervised a limited number of cases. The cost of these additional services, the cost of hospitalization, welfare, and the services of a number of agencies devoting all or a part of their time to the tuberculous would run into millions of dollars per annum.

The over-all expenditures by the Department of Health are shown in a condensed form in Table 3. It will be noted that no charge has been made for rent, heat, light, and power. The majority of the twenty-three clinics' services operated in 1940 were located in city-owned buildings where the above services were provided for the building as a whole and exact operating costs for the chest service could not be made with reasonable accuracy. Items of this character included in the cost analysis of services elsewhere should,

Table 3. Expenditures for tuberculosis control by the Department of Health, New York City, 1940.

TYPE OF EXPENDITURE	AMOUNT
Personnel	\$531,136.62
1. Central Office Administration	\$ 46,275.37
2. Clinic Physicians Sessions	91,715.96
3. Bureau of Nursing	282,255.18
4. X-Ray Technicians	34,712.50
5. Stenographic Service	5,447.10
6. WPA Clerical	70,730.51
Other than Personnel	\$136,720.61
1. X-Ray Films and Chemicals	36,223.00
2. Survey X-Ray Films	66,567.61
3. Depreciation on Equipment	6,000.00
4. Sputum Examinations	21,000.00
5. Others	6,930.00
TOTAL EXPENDITURES	\$667,857.23

therefore, be removed if comparison on a comparable basis is desired. The District Health Officer and his immediate staff contribute something to the tuberculosis program but it has been impossible to isolate these items of cost with reasonable accuracy.

It is important that the major items set forth in Table 3 be enlarged upon so that the reader may have a clearer idea of the details of the service.

*Central Office Administration.* Under this heading are included the following: (a) salaries of the Director and two full-time Medical Supervisors; (b) full-time salary of the Supervising X-Ray Technician; (c) salaries of two part-time Medical Supervisors; (d) clerical and stenographic personnel in the central office (the Master case roster for the entire City is located in the central office and all cases reported are routinely checked against it. The Central Record File Division also serves as a repository for abstracts of discontinued district clinic case records and their x-rays); (e) the salary of WPA clerks who make abstracts of clinic case records and operate the files used in this work.

*Clinic Physicians' Sessions.* The clinic physicians worked a total of 18,360 sessions of three hours each for which they are compensated at the rate of five dollars per session. This total also includes one physician on full time at \$4,000 per annum who was financed jointly by Cornell University Medical School and the Rockefeller Foundation in the conduct of a special program in one of the Health Department clinics.

*Bureau of Nursing.* All nursing service in chest clinics or in the field is under the Bureau of Nursing of the Department of Health. The majority are Civil Service employees with a few additional available through WPA funds. The various items included in this category are as follows: (a) full-time salaries for the Superintendent and Specialist in Tuberculosis; (b) a pro rata share of the salary of the Director of the Bureau and various district supervisors that may be reasonably charged to tuberculosis activities; (c) the cost of staff

nurses, estimated on the basis of hours worked in behalf of the tuberculous and the average salary of a Civil Service nurse (this type of estimate was necessary because the Bureau operates almost wholly on a generalized plan and nurses are constantly shifting from area to area); (d) the cost of services of nurses provided through WPA estimated in the same manner as those of the Civil Service nurse; (e) the cost of the Bureau's use of clerks and stenographers in the operation of the district branch offices that devote the major part of their time to the tuberculosis files.

The expenditures for nursing services were divided between clinics and other than clinic services. The cost for clinic services was \$158,697.70 and for other than clinic services, \$123,557.48.

*X-Ray Technicians.* There are twenty full-time positions not including the Supervising Technician indicated under Central Office Administration.

*Stenographic Service.* There were three such positions assigned to district clinics doing only tuberculosis work but charged to the budget of the Bureau of Tuberculosis. There are stenographic services used in other clinics which are a part of the District Health Officers staff and have not been included here.

*WPA Clerical.* This item covers the salaries of clerks, stenographers, and statistical workers who devote their entire time to the mass x-ray survey project operated by the Department in cooperation with WPA.

*Other Than Personnel.* (a) X-ray films and chemicals covers the cost of those items used in the various district clinics. During the year 108,294 films were processed, not including the survey films. (b) Survey x-ray films refers to the cost on a service basis for the paper films used in surveys. The vendor provides film, equipment, and personnel to expose and process the films ready for interpretation. The funds for these films are expended by WPA although they are secured from the City of New York as part of the sponsor's contribution to the project. (c) The depreciation on x-ray equipment

was estimated on standard formulae for such calculations. (d) The Bureau of Laboratories examined 80,134 sputa in 1940 and it is estimated that 60,000 were for the clinic services and the remainder for physicians or others who use the laboratory. The unit cost per examination has been estimated at 35 cents by the Director of the Bureau of Laboratories on the basis of overhead, materials, and personnel devoted to this type of service. (e) Other items included carfare and travel allowance, medical and surgical supplies, *i.e.* replacement of x-ray tubes etc., general plant supplies, and equipment and office supplies. Each item is an estimate based on the experience of a given six months.

The nursing and clerical personnel provided through WPA represents a total of \$103,298.81 which is 15 per cent of the total expenditures, the survey project accounting for 70 per cent of this total.

There has been no charge made for health education literature as the great bulk of such material used for 1940 was received from the local Tuberculosis and Health Associations, and other sources without cost to the Department.

#### UNIT COST OF CASE FINDING IN CLINICS

The cost of case finding in the clinic is not merely the cost of operating the individual clinic with the salaries of personnel, materials and supplies used. The central office has an over-all direction and provides supervisory and other services that make it possible for each clinic to function smoothly. Likewise, the field service rendered by the nurse plays an important part in getting cases into the clinic for examination, and securing the return of patients in which diagnoses are incomplete. The same may be said of the district branch office staff who are responsible for filing, transcribing, and otherwise making the record material of the clinic or field nurse quickly available to either group.

It is possible to separate the total costs of the mass survey program

ACTIVITY	NUMBER	UNIT COST
New Admissions	47,314	\$11.77
Individuals Examined	69,176	8.05
Attendance	189,272	2.94
Diagnoses		
Chronic Pulmonary Tuberculosis	5,684	97.97
Clinically Significant	3,733	149.18
Arrested	1,951	285.44

Table 4. Activities and cases diagnosed in district chest clinics with the unit cost of each based on a total expenditure of \$556,886.96 in 1940.

from the gross cost of our services for 1940 by subtracting the former, less the items for rent, telephone, and electric service that has been included in the figures for surveys but were not estimated in the totals (item 2), shown in Table 1. This figure is \$110,970.27. Thus, the cost of operating the tuberculosis control services less the surveys in 1940 was \$556,886.96.

An analysis of certain clinic data has been set up in Table 4 with an indication of the unit cost based on the total cost of clinic operation excluding the cost of surveys.

#### DISCUSSION

The unit cost of finding a case in the clinics was \$97.97 per case of chronic pulmonary tuberculosis and \$149.18 for a significant case. The respective costs for the surveys for the entire year were \$69.64 and \$187.88. Thus, in the finding of a chronic case, the clinic method was 29 per cent greater than the cost in the survey, but, on the other hand, the unit cost of a significant case in the survey was 26 per cent greater than in the district clinic.

It is of interest to point out that in another study (2) of Inductees and National Guardsmen, the unit costs were consistently higher than in the studies presented here. The unit cost in the Inductees was \$127.23 for chronic pulmonary tuberculosis and \$329.03 for a significant case. In the Guardsmen, similar costs were \$145.07 and \$343.22. These unit costs were divided into (a) the cost of taking a

roentgenogram and its interpretation and (b) the complete cost from the time of first x-ray to follow-up and final disposition. The unit cost in (a) was \$63.93 for Inductees and \$70.93 for Guardsmen while in (b) the unit costs were \$106.02 for Inductees and \$122.37 for Guardsmen.

The expenditure for surveys of \$110,970.27 was only 16.6 per cent of the total expenditures of the Department for all tuberculosis services. From a superficial examination it might be concluded that the survey method as here reported is a cheaper method and therefore should replace the established routine clinic service. This, however, is not the fact.

A previous report by Plunkett (3) has indicated cost analyses of case finding. His unit costs "per individual, including reexaminations is conservatively estimated at five dollars," a figure much lower than the individual cost of \$8.05 in our study (Table 4). On this basis he indicates the cost of finding a new case of tuberculosis as \$171, the cost being \$4,419 for those under 15 years of age and \$122 for those 15 years or over. As the age increases the cost per case decreases until it reaches \$78 for those 45 years and over. Also his unit costs on new patients are considerably lower than the costs on cases found by reexamination.

Another study (4) based on estimated costs in New Haven gave unit costs per contact examined as \$11.62 which is considerably higher than the individual unit cost of \$8.05 reported in this study. The unit cost for all chronic pulmonary tuberculosis was \$42.90 and \$157.70 for an active case. The costs varied widely on the basis of the type of index case. Thus contacts in families with an index case of tuberculous meningitis was \$78 per active case, \$140.51 per active case where the index case was pulmonary tuberculosis (81.5 per cent of index cases were known to have positive sputum), and \$1,063.50 where the index case was a child with a positive tuberculin.

It is perhaps unwise to attempt to compare the foregoing surveys with the figures presented in this report as the reports by Plunkett

and Edwards based their unit costs on estimates that probably are not comparable. The study in New Haven included an estimated cost per visit by the Visiting Nurse Association at \$1.00, probably low. It did not include cost of medical personnel in the clinic and many other items that have been included in this study that would tend to increase the unit costs. They are of interest, however, to point out the great importance of careful and exact cost analysis of this type of work.

The prevalence of chronic pulmonary tuberculosis among persons examined in the district clinics in 1940 was four and one-half times the prevalence in the survey population, namely, 8.2 per cent as compared with 1.8 per cent. An even greater difference in the prevalence of significant tuberculosis was noted. It was 5.4 per cent in the district clinic which is eight times the rate 0.67 noted in the surveys. Obviously, the district clinic was serving a population which yielded a larger number of both types of cases.

The clinics for the most part attract those individuals known to have been exposed to tuberculosis or those in whom there are symptoms or some particular cause for seeking examination. On the other hand, the survey program as set up appeals chiefly to those in apparent good health and who probably request a chest x-ray more for the purpose of assurance that they are sound and healthy than for discovery of the cause of symptoms.

There are also differences in the classification of significant and arrested tuberculosis in the district clinics and in the mass surveys. In the former, there has been a tendency to consider a much higher percentage of all lesions found as significant until routine periodic supervision has demonstrated their stability. This is based, in part, on the fact that many of the cases found are known to have had exposure in the past; also, it has been the policy of the clinic to supervise cases for a much longer period of time as a matter of routine. In the mass surveys of apparently healthy adults, the classification of cases is usually made on the first follow-up examination

following the survey x-ray. There is no attempt made by the survey unit to follow such cases indefinitely; if the case gives every characteristic of arrest, they are so classified. Also, there is usually no knowledge of exposure in the cases found in surveys. On the basis of subsequent supervision of cases classified as arrested by the survey unit, and the follow-up of associates to detect other cases in families, it has been found that the survey method of classification of arrest is sound, and that this type of index case is not important as a lead to other cases of tuberculosis among associates.

The survey as operated in New York City, a mobile facility moving from group to group to provide rapid x-ray examinations of large numbers, would be ineffective in the long run if adequate facilities were not available for the follow-up of the cases found and, where necessary, of their contacts. In fact, the mass survey program should never be used unless the agency has adequate facilities for complete check-up on cases detected in the survey x-ray and for the proper subsequent supervision indicated in the individual case or family. Therefore, the district clinic service in New York City is a very important part of our mass survey program, but there is no clear cut dividing line where one stops and the other starts so that an exact cost figure is not possible without extensive cost analysis of every expenditure. That was not possible at the time.

In the tuberculosis program in New York City, the Department of Health has, for a number of years, attempted to reduce unit costs in the clinics by eliminating all nonessential procedures. In an ideal program one might attempt to supervise, for an indefinite period, all those individuals infected as shown by a positive reaction to the tuberculin test. Such a plan in most communities is impossible to accomplish and here in New York City, it is felt that it would be a waste of our limited facilities. Therefore, we have come to supervise in the clinic chiefly those with lesions demonstrable by x-ray. In addition those in adolescence and young adult life who have been exposed to open cases and are known to be at great risk of develop-

ing tuberculosis are supervised even though a lesion may not be found by x-ray. Over the past few years the district clinic has admitted an increasing number of individuals with indefinite symptoms, persons somewhat comparable with apparently healthy adults seen in the mass surveys.

Three years ago, in the Kips Bay-Yorkville Health Center, a program was set up to establish criteria for mass surveys on a limited basis in the district clinic. This program was a joint enterprise between the Departments of Health and Welfare, and has clearly indicated a method of the greatest value in case finding on a permanent district basis.

This study has been of the greatest interest in a number of respects. (a) It has demonstrated that two large city departments, ordinarily operating entirely independently one of the other, can combine forces that are mutually beneficial and of distinct value to the control of tuberculosis in the community. (b) The social case workers of the Department of Welfare, during their routine visits to the homes of relief clients, were able to secure the voluntary cooperation of approximately 72 per cent of all those 15 years of age or older and with no known tuberculosis, to come to the district clinic for an x-ray of the chest. (c) The Department of Health was able, during the three-year period, to utilize the unused time of its local x-ray facilities and personnel to accommodate an additional 5,153 examinations. It was only necessary to add one clerk to assist in the x-ray laboratory in this program. (d) The yield in significant cases, all new, ranged from 2.2 to 3.0 per cent which proportion is in agreement with the extensive experience in this type of population in other surveys in New York City.

It has been estimated that from six to seven thousand new cases of significant tuberculosis would be found if a similar program which would reach all individuals above 15 years of age on home relief were set up in all district clinics. Unfortunately, not all of our district clinics have the available time from routine duties found at

Kips Bay-Yorkville and for the most part the busiest clinics are in those areas where the relief population is highest. The program is sound, however, and localized mass surveys should, if possible, be developed in conjunction with the regular clinic services.

In the foregoing program, all persons 15 years or older were re-x-rayed for three successive years if they were negative on the previous year's film. Practically no new cases were found among those re-x-rayed, indicating that the x-ray evidence at a given time represents the cumulative disease developed from birth to the time of examination. Thereafter, the case incidence rate will probably be the same as for the population as a whole, unless the individual be continuously exposed to infection and living under conditions that reduce resistance and, therefore, predispose to the development of disease.

It would be presumed, therefore, that a practical program for this type of population would provide (1) a chest x-ray for all persons on home relief who are 15 years of age or older, and not known to have the disease; (2) that all new individuals coming onto relief would have a chest x-ray; (3) a re-x-ray on an annual basis for all of those from 15 to 25 years who have been or who are exposed to open tuberculosis. A possible exception to this plan might be made in the case of the colored population in whom tuberculosis tends to progress rapidly and who, as a rule, are less resistant to the disease. For them, re-examination on an annual basis regardless of known exposure might be well from ten years of age onward.

#### CONCLUSION

The expenditures for tuberculosis control by the various services of the Department of Health in 1940 have been presented.

Evidence is produced which conclusively indicates that the adult of low economic or social status is a more productive source of new cases than other groups.

Surveys of high school groups, even among the colored and those

representing low income levels, should be first preselected with the tuberculin test to eliminate those not infected.

Unit cost figures are presented for various groups in mass surveys, and for the cases examined in the district chest clinic. While there appear to be wide differences in these costs by the two methods, there is no reason to conclude that one method is necessarily better than the other. In fact, the success of the mass survey of apparently healthy adults in the long run demands the established district clinic to provide the continued supervision indicated in cases found by the survey.

A joint program between the Department of Health and the Department of Welfare has been presented which indicates how the district clinic can utilize any unused time in the development of a mass survey of apparently healthy adults in addition to its regular duties.

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# THE SHELTERED WORKSHOP IN THE REHABILITATION OF THE TUBERCULOUS

MEDICAL EXPERIENCE AT ALTRO, 1915-1939<sup>1</sup>

LOUIS E. SILTZBACH, M.D.

THE war gives our subject added meaning. The hunt for industrial manpower has pointed up the urgency of utilizing the physically handicapped in the battle of production. Government, industry, and labor are asking how the tuberculous worker can be fitted into the present industrial set-up. They wish to know from the medical men which workers to choose and what are their prospects.

It is believed that Altro Work Shops have some of the data to give them the assurances that they require. In fact, some alert sections of industry already have instituted schemes of industrial convalescence for the tuberculous—graduated part-time employment—and can testify to the good results that have been achieved. State and federal rehabilitation and employment services which have had experience in the vocational training and placement of tuberculous ex-patients can affirm the optimistic attitude we take here today.

What does the experience of the Altro Work Shops show? How much is this experience worth and how can it be used as a guide in the general field of the rehabilitation of the tuberculous and in the specific area of the sheltered workshop's function?

The Altro Work Shops is a garment factory manned by tuberculous ex-patients working under medical supervision. It has been functioning under the direction of the Committee for the Care of the Jewish Tuberculous, Inc. for the past twenty-seven years. Successful operation for so long a period is, in itself, something of an accomplishment. It is our belief that Altro's experience is particu-

<sup>1</sup> Presented at a symposium "Readjustment of the Tuberculous to Normal Life," Altro Work Shops, October 22, 1942.

larly valuable because it demonstrates that you can take tuberculous ex-patients who are discharged from a sanatorium in the moderately and far-advanced stages of the disease, place them at part-time work at machines in a factory and run this factory just as smoothly as any in private industry. And that, without in any way sacrificing the worker's health interests. You can place them at work and gradually increase their confidence, their *joie de vivre*, their work capacity to a point where many of them become self-supporting and are able to work full time in preparation for their return to their places in every-day life.

Altro has been able to do this primarily because it has treated the worker and his family as a unit, has supplemented, where necessary, the worker's earnings by a subsidy sufficient for the family's needs and has kept the worker during his stay at Altro under closely supervised medical observation approximating that of the sanatorium. In fact, the parent Committee does more than that. Often the Altro worker is seen at the time of initial diagnosis and if he is cared for at the Montefiore Country Sanatorium, the Committee, acting as the social service agency for that sanatorium, works with the family, takes care of its health needs and contributes to its support while the patient is at the sanatorium. This many-sided program enables the patient to go through an adequate span of treatment with his all-important mental burden considerably lessened.

The Altro data show that the morbidity and mortality rates among such workers can be reduced to a gratifyingly low level. Furthermore, workers who pass through the entire course, achieving full work tolerance and graduating, have essentially as favorable a record of survival after graduation from the workshop as that of the general population. One could not give any group of handicapped people a higher recommendation.

An analysis based on the experience of all tuberculous ex-patients who worked at the Altro Work Shops beyond a three-months' probationary period during the years 1915 to 1939 follows. Nine hun-

dred and sixty-four workers were admitted for the first time during this period and where possible they were followed to the closing date of the study, July, 1941.

The longest period of observation was twenty-five years after discharge from the workshop. The average period of observation was 7.8 years. Ninety-seven per cent of the workers were traced to the end of five years and 92 per cent for ten years.

#### GENERAL DESCRIPTION OF ALTRO WORKERS

Before the experience of workers during their Altro stay and that of the post-Altro years is discussed, they shall be described as they were up to the point of admission to the workshop.

*Sex.* There were 705 males and 259 females.

*Marital Condition.* Three of every five males were married at admission, but only one of six of the female workers.

*Age.* Half of the workers were under thirty years of age at Altro admission. The median age for the male workers was 33 years; for the female workers 25 years. Ninety-seven per cent were from 15 to 49 years of age.

*Occupation.* Of the Altro workers who were employed before their illness, 41 per cent were either garment workers or workers in some related sewing trade. Other occupational groups were clerks, salesmen, semi-skilled operatives, and laborers.

About three out of four garment workers who had jobs after leaving the workshop remained in this occupation. In addition, a little less than one in five of the nongarment workers became garment workers after leaving.

*Medical Status of Workers at Admission to Altro.* Altro workers are accepted from all sanatoria but because we have close working arrangements with the Montefiore Country Sanatorium, 62 per cent of our workers came directly from that institution. The median stay at all sanatoria preceding Altro admission was 14.4 months. About 6 per cent had had no sanatorium experience or had remained in an institution for less than thirty days. However, many of those with-

out sanatorium experience before Altro had been treated in rest cottages. All the workers had had some treatment previously.

From the date of sanatorium discharge to the date of admission to the workshop, there was a median time interval of 4.3 months. The median stay at the workshop for all workers was 16.8 months.

Before presenting the facts on the clinical classification of our workers, it may be stated that the pre-Altro sanatorium data were reexamined and reclassified in conformity with the present-day standards of the National Tuberculosis Association.

*Stage of Disease.* At Altro admission 21 per cent of the workers had disease which was minimal in extent, 42 per cent were moderately advanced, and 37 per cent were far advanced. Thus, four out of five of our workers came to us in the moderately or far-advanced stage of disease.

*Condition or Clinical Status on Admission.* With regard to the worker's clinical status or condition on admission to the workshop, 64 per cent were arrested, including a few apparently cured; 11 per cent were apparently arrested; 17 per cent were quiescent; and 8 per cent were unstable or frankly active. Workers with frankly active disease dated back, for the most part, to the early days of operation of the workshop.

*Sputum History.* The clinician at the bed-side directs his therapy primarily at closing the patient's cavity and ridding him of his positive sputum. Sputum conversion has become the touchstone of successful treatment in pulmonary tuberculosis. Therefore, in addition to the two classifications cited, *i. e.*, stage and condition, it was found useful to employ a third grouping based on the ex-patient's sputum history before admission to the workshop.

The workers were divided into three groups. First, those workers who never had had a positive sputum and still had a negative sputum when admitted to the workshop—*minus-minus* group; second, those workers who had not been rid of their positive sputum at admission to the workshop—*plus-plus* group; third, those re-

maintaining workers who had had a positive sputum some time during their illness which had been successfully converted to a negative sputum before admission to the workshop—*plus-minus* group. Such grouping contains an unknown degree of error since the frequency of sputum examinations and refinements in the bacteriologic technique employed varied from sanatorium to sanatorium and changed from period to period.

At admission to the workshop, 30 per cent of the workers were in the minus-minus group, 15 per cent were in the plus-plus group, and 55 per cent were in the plus-minus group.

Because of the extended period of observation, the workers were divided chronologically into two groups: those admitted to the workshop in the years 1915 to 1929, a group of 445 persons; and those of the years 1930 to 1939, 519 persons. Such a division differentiates the patients of the pre-collapse therapy era from those of the period wherein collapse therapy was prominent.

During the past quarter century the clinical composition of our tuberculosis sanatorium population has changed and these changes were reflected in the make-up of the Altro population. In the days preceding the frequent use of serial chest x-rays, refined bacteriologic methods and collapse therapy, sanatoria were discharging proportionally more patients with progressive or quiescent disease, patients with open cavities and positive sputum which persisted despite bed rest therapy. At the other end of the scale, patients with old calcified lesions or old fibrous scars of no clinical significance were admitted and treated for active tuberculosis. Between these two groups were the patients admitted to the sanatorium with active lesions, open or closed, which responded favorably to bed rest therapy. It is the middle group of the successfully treated patients which has increased in the collapse therapy era with consequent reduction in the other two groups cited. The improvement in the clinical status of patients discharged from sanatoria since 1930 is a world-wide phenomenon. It is present in the British, Dutch, and

Swiss sanatorium statistics as well as our own. It enables us to broaden our base considerably, in planning the rehabilitation of our tuberculous patients.

Altro workers admitted during the years 1930 to 1939 were classed clinically in the more stable groups. Thus, only 6 per cent were admitted to the workshop with a positive sputum as against 25 per cent in the earlier period. This drop in percentage of those admitted with a positive sputum was to a great extent due to refusing admission to patients with frankly active disease.

Even more striking was the rise, from the early to the late period, in the percentage of workers admitted with successfully converted sputum—the plus-minus group. There were 38 per cent in the earlier period; 69 per cent in the later period.

In addition, many workers with disease of minimal extent were judged to be not in need of a sheltered workshop regimen during the later period. There was a change in the proportion in the minimal group. Such cases formed 31 per cent in the earlier period as compared with 12.5 per cent for the last ten years of the survey. At the same time, there was a rise in the proportions of the moderately-advanced and far-advanced groups to 48.2 per cent and 39.3 per cent, respectively.

Finally, workers of the later period gave a history of a longer stay in the sanatorium than those of the earlier period of operation—16.8 months as against 11.3 months. This finding is also in keeping with the modern objectives of the sanatorium to close cavities and rid the sputum of tubercle bacilli.

*Treatment Before Altro Admission.* The type of treatment received by the workers before Altro admission differed markedly in the two periods. In the group admitted to the workshops from 1915 to 1929, only about 6 per cent of the workers received collapse therapy—all pneumothorax patients. (Patients with six months or longer of pneumothorax are included.) In the later period, 1930 to 1939, 52 per cent of the workers had received some form of col-

lapse therapy—40 per cent had had pneumothorax, 7 per cent had had thoracoplasty and 5 per cent had had phrenic nerve operations. One hundred sixty workers came to Altro with pneumothorax. Three-quarters of these workers had continued to receive their refills throughout their Altro stay.

The workshop, then, has been devoting itself increasingly to the plus-minus, arrested groups of ex-patients, those who can be expected to reap the greatest profit from a temporary rehabilitation course.

The foregoing analysis of the status of workers on admission to the workshop indicates that the group as a whole was not unduly weighted by ex-patients in the most favorable clinical category. They may be considered a representative cross-section of the type of ex-patient rehabilitation offices are called upon to help.

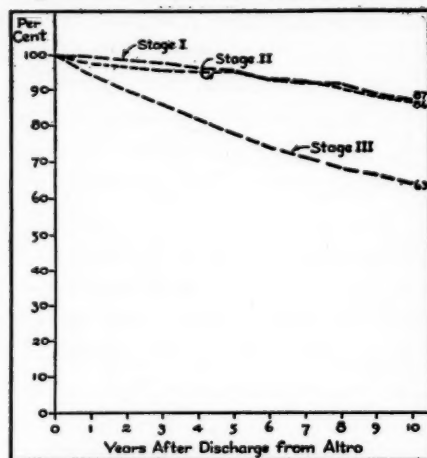


Fig. 1. Per cent of patients who survived in successive years after discharge from Altro. Patients classified according to stage at admission.

#### SURVIVAL RATES AND MORTALITY OF ALTRO WORKERS

To study the general mortality, and the tuberculous morbidity and recurrence rates of our workers, an adaptation of the modified life-table method as suggested by Frost (1), and applied by Downes (2), Hilleboe (3) and others has been used.

Figure 1 and Tables 1, 2, and 3 show the rate of survival annually up to ten years post-Altro according to stage of disease at Altro admission. At the end of ten years, 87 per cent of the minimal or first-stage workers had

YEARS AFTER DIS- CHARGE	PERSONS AT BE- GINNING OF YEAR	WITH- DRAWN DURING YEAR	AVERAGE AT RISK DURING YEAR	NUM- BER OF DEATHS	PER- CENTAGE DYING DURING SELECTED YEAR	PER- CENTAGE SURVIVING THROUGH SELECTED YEAR	PER- CENTAGE SURVIVING THROUGH PAST AND SELECTED YEARS
1	201	10	196.0	1	.51	99.49	99.49
2	190	14	183.0	2	1.09	98.91	98.41
3	174	2	173.0	1	.58	99.42	97.84
4	171	4	169.0	3	1.78	98.22	96.10
5	164	5	161.5	1	.62	99.38	95.50
6	158	7	154.5	5	3.24	96.76	92.41
7	146	6	143.0	1	.70	99.30	91.76
8	139	11	133.5	1	.75	99.25	91.07
9	127	5	124.5	4	3.21	96.79	88.15
10	118	10	113.0	2	1.77	98.23	86.59

Table 1. Survival rates after discharge from Altro of patients having minimal tuberculosis on admission.

survived and 86 per cent of the moderately-advanced or second-stage workers. The survival rates for workers in these two stages of disease

Table 2. Survival rates after discharge from Altro of patients having moderately advanced tuberculosis on admission.

YEARS AFTER DIS- CHARGE	PERSONS AT BE- GINNING OF YEAR	WITH- DRAWN DURING YEAR	AVERAGE AT RISK DURING YEAR	NUM- BER OF DEATHS	PER- CENTAGE DYING DURING SELECTED YEAR	PER- CENTAGE SURVIVING THROUGH SELECTED YEAR	PER- CENTAGE SURVIVING THROUGH PAST AND SELECTED YEARS
1	397	17	388.5	9	2.32	97.68	97.68
2	371	27	357.5	4	1.12	98.88	96.59
3	340	29	325.5	4	1.23	98.77	95.40
4	307	23	295.5	1	.34	99.66	95.08
5	283	29	268.5	0	0	100.00	95.08
6	254	32	238.0	6	2.52	97.48	92.68
7	216	31	200.5	1	.50	99.50	92.22
8	184	27	170.5	4	2.35	97.65	90.05
9	153	28	139.0	4	2.88	97.12	87.46
10	121	27	107.5	2	1.86	98.14	85.83

YEARS AFTER DIS- CHARGE	PERSONS AT BE- GINNING OF YEAR	WITH- DRAWN DURING YEAR	AVERAGE AT RISK DURING YEAR	NUM- BER OF DEATHS	PER- CENTAGE DYING DURING SELECTED YEAR	PER- CENTAGE SURVIVING THROUGH SELECTED YEAR	PER- CENTAGE SURVIVING THROUGH PAST AND SELECTED YEARS
1	350	20	340.0	19	5.59	94.41	94.41
2	311	22	300.0	14	4.67	95.33	90.00
3	275	20	265.0	12	4.53	95.47	85.92
4	243	19	233.5	12	5.14	94.86	81.50
5	212	18	203.0	10	4.93	95.07	77.48
6	184	22	173.0	9	5.20	94.80	73.45
7	153	21	142.5	5	3.51	96.49	70.87
8	127	17	118.5	5	4.22	95.78	67.88
9	105	13	98.5	3	3.05	96.95	65.81
10	89	9	84.5	3	3.55	96.45	63.47

Table 3. Survival rates after discharge from Altro of patients having advanced tuberculosis on admission.

were almost identical throughout the period. The rate of survival for workers with far-advanced disease was different. It decreased steadily and fairly rapidly; at the end of ten years 63 per cent of these workers were alive.

Figure 2 shows the rate of survival related to the sputum history of workers at Altro admission. At the end of ten years, 84 per cent of both minus-minus and plus-minus groups of workers were alive. There was a similarity in the level of the survival rates for workers in these two sputum groups throughout the period. These data indicate that workers who had had a positive sputum some time during their illness which had successfully been converted to a negative sputum before admission to the workshop (plus-minus group) had an expectation of survival quite as favorable as those of workers who had never had a positive sputum (minus-minus group). A similar experience was reported by the British observers Bardswell and Thompson (4).

The survival rates of workers admitted to the workshop with a positive sputum—plus-plus group—are quite different from those of the other sputum groups. The rates decreased sharply in the early years post-Altro, and at the end of ten years 54 per cent of these workers had survived.

As early as 1916 King (5) called attention to the value of sputum history as a simple prognostic indicator in pulmonary tuberculosis. These data from Altro confirm this. When our third stage workers were further analyzed on the basis of their sputum history, it was found that 84 per cent of those with successful conversion of the sputum be-

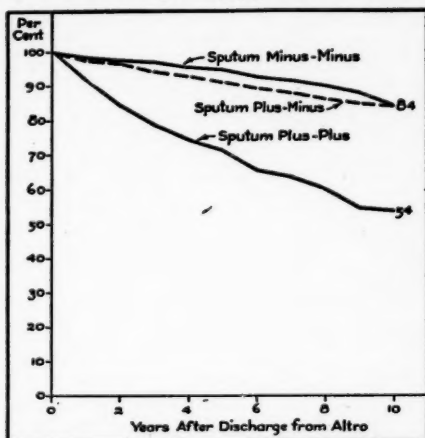


Fig. 2. Per cent of patients who survived in successive years after discharge from Altro. Patients classified according to sputum on admission.

fore admission to the workshop were alive six years after discharge from Altro, whereas only 58 per cent of those admitted with a positive sputum survived. Obversely for these six years the percentage of the plus-plus third stage group that *did not survive* was about two and one half times greater than that of the plus-minus third-stage group. Successful sputum conversion before admission to the workshop thus gave to workers with far-advanced disease an expectation of survival somewhat similar to that for persons with minimal or moderately-advanced disease. At the end of six post-Altro years the per cents surviving were 84 and 92, respectively. The importance of sputum conversion for these far-advanced workers is evident.

Figure 3 shows the rates of survival annually up to ten years post-

Altro related to condition of workers at Altro admission. Of the workers classed as arrested and apparently cured, 86 per cent were alive at the end of ten years. For workers who were quiescent or

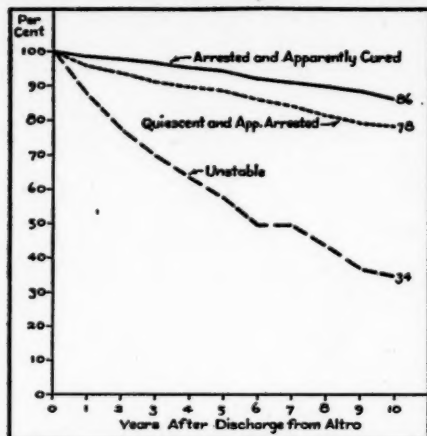


Fig. 3. Per cent of patients who survived in successive years after discharge from Altro. Patients classified according to condition at admission.

apparently arrested, the proportion was slightly smaller — 78 per cent; but only 34 per cent of the unstable, frankly active patients were alive at the end of ten years. As previously stated, the unstable patients belong to the early period of the workshop's operation. The poor prognosis of patients with open cavities and unstable lesions evident on the x-ray film is common

knowledge today. Such patients either require further treatment at an institution or simply custodial isolation.

*Mortality of Altro Workers Compared with the General Population.* The mortality of the Altro group after discharge is compared with that of the general population in Table 4. The results are expressed in terms of the ratio of the actual deaths to the number expected in a population of the same size and same composition of sex and age. The standard of comparison was the mortality from all causes in the white population of New York City during the period covered by this study. For the entire experience the mortality of the Altro workers was about twice that of the general population. A similarity in mortality was found between the two sexes when the death rates were adjusted so as to take account of the difference in age distribution of the two sexes.

AGE GROUPS	ALTRO ADMISSIONS 1915-1939			RATIO OF ACTUAL TO EXPECTED DEATHS
	Years of Life Exposed	Actual Deaths	Expected Deaths	
ALL AGES	9269.5	180	85.71	2.10
15-19	81.5	1	0.18	5.56
20-24	798.5	14	2.15	6.51
25-29	1,464.5	20	4.69	4.26
30-34	1,507.0	22	6.03	3.65
35-44	2,713.5	51	17.64	2.89
45-54	1,986.0	45	28.99	1.55
55-64	641.0	24	20.90	1.15
65-74	77.5	3	5.13	0.58

Table 4. Ratio of actual to expected deaths from all causes among patients discharged from Altro, 1915-1939.<sup>1, 2</sup>

<sup>1</sup> Expected deaths calculated on the basis of mortality from all causes among white persons in New York City. Mortality in the following years was used to obtain an average for the period through which the life experience of Altro patients passed; 1922, 1923, 1924 and 1933, 1934, 1935.

<sup>2</sup> No significant difference in specific sex ratios was present when the male deaths, actual and expected, were adjusted to the female years of life.

Among Altro workers in the aggregate the ratios were highest in the third decade of life, deaths being six times the expected rate at that age period. The ratios declined steadily and at 55 years and over the Altro patients experienced about the same mortality as persons of the same age in the general population.

When stage of disease was considered as shown in Table 5, Altro workers with minimal disease were found, in the aggregate, to have a mortality experience not unlike the general population, the ratio of the actual to the expected being only 1.04. The patients in the moderately-advanced stage had in the aggregate a mortality rate of one and one-half times that expected in the general population (Ratio 1.53) and for the patients in the far-advanced stage, it was four times that of the general population (Ratio 4.01).

These are quite favorable ratios for a group of tuberculous workers. Equally high ratios are encountered in the general population among apparently well persons in certain economic and occupational groupings.

CLASSIFICATION BY STAGE AT ADMISSION TO ALTRO	YEARS OF LIFE OBSERVED	EXPECTED NUMBER OF DEATHS	ACTUAL NUMBER OF DEATHS	RATIO OF ACTUAL TO EXPECTED DEATHS
ALL STAGES	9,210.5	85.71	179	2.09
Minimal	2,574.5	28.97	30	1.04
Moderately Advanced	3,691.0	30.75	47	1.53
Advanced	2,945.0	25.41	102	4.01

Table 5. Ratio of actual to expected deaths post-Altro among patients classified according to stage at admission, 1915-1939.<sup>1</sup>

<sup>1</sup> Expected deaths calculated on the basis of age-specific mortality from all causes among white persons in New York City. Data from the following years were used to obtain an average for the period through which the life experience of Altro patients passed: 1922, 1923, 1924 and 1933, 1934, 1935.

### MORBIDITY RATES OF ALTRO WORKERS

Since pulmonary tuberculosis is a chronic recurrent illness which is disabling for long periods of time, it is important to know how often and at what period recurrences take place and how much of his time the patient spends in "curing" for such recurrences.

"Recurrence" is defined as reactivation of tuberculosis with resumption of "cure" either at home or at an institution. Recurrence rates for Altro patients have also been computed by the modified life table method. In the later period of the study, recurrences were frequently detected on routine chest x-ray films before the appearance of symptoms or of a positive sputum.

Recurrence rates of patients classified according to sputum history at admission to Altro are shown in Figure 4 and Table 6. The chances of having a breakdown after admission to the workshop were found to vary with the sputum history and the time after admission. At the end of ten years, 27 per cent of the workers with a minus-minus sputum history had had a recurrence compared with 30 per cent of the workers in the plus-minus group. When these two sputum groups are combined, at the end of ten years 28 per cent had a recurrence of illness. The average annual recurrence rate was 3.2 per 100. These two groups totaled 790 patients or 85 per cent of the workers admitted to the workshop.

Workers admitted to the workshop with a positive sputum showed much higher recurrence rates, the majority of recurrences taking place within two years after admission. At the end of ten years, 76.3 per cent of these workers had had a recurrence but the greater part of these occurred among the frankly active patients admitted to the workshop in the early period of operation.

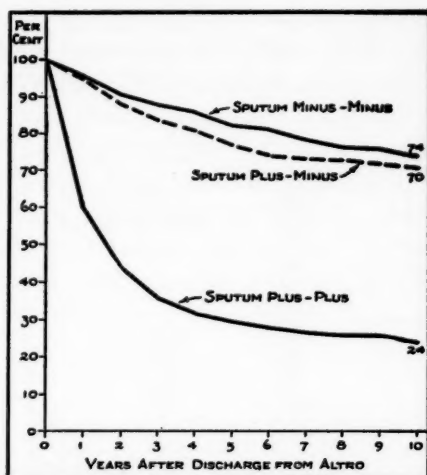


Fig. 4. Per cent of patients with no recurrence of illness during ten years after admission to Altro, 1915-1939.

The next presentation concerns the percentage of total time spent in "curing" from all tuberculous illness following Altro discharge.

Table 6. Per cent of patients with no recurrence of illness during ten years after admission to Altro, 1915-1939.<sup>1</sup>

YEARS AFTER ADMISSION TO ALTRO	PER CENT WITH NO RECURRENCE DURING PAST AND SPECIFIED YEARS		
	Minus - Minus Sputum	Plus - Minus Sputum	Plus - Plus Sputum
1	95.79	94.65	59.71
2	90.15	87.79	43.88
3	87.94	83.15	35.87
4	85.61	80.52	31.52
5	81.75	76.48	29.30
6	80.88	73.52	27.84
7	77.91	72.47	26.24
8	75.72	72.14	25.39
9	75.72	71.16	25.39
10	73.66	70.13	23.72

<sup>1</sup> Patients classified according to sputum status on admission to Altro.

The data are given in Figure 5 in three five-year periods and are related to the worker's sputum history at Altro admission.

The results are striking. The workers of the minus-minus group

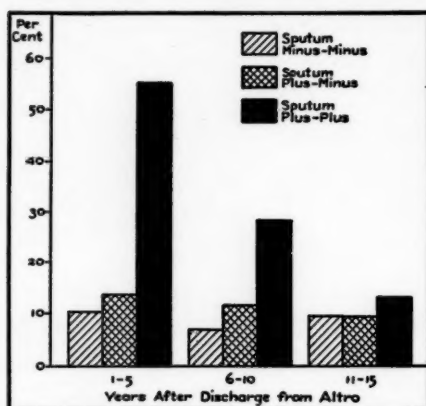


Fig. 5. Per cent of years alive that were tuberculous sick years post-Altro.

spent 10 per cent or less of their time in bed in all three five-year periods. The plus-minus workers were quite similar in this respect to the minus-minus group. They spent a slightly greater proportion of their time "curing" in the first two five-year periods than did the workers of the minus-minus group; but for the last period, the figures

were identical.

Considerably less favorable are the figures for the group of workers who entered the workshop with a positive sputum. In the first five years after discharge, these workers were invalidated by tuberculosis 55 per cent of the time. This was four to five times that of the more favorable sputum groups. In the second and third five-year periods, the proportion of sick years spent in "curing" decreased to 28 per cent and 13 per cent, respectively. Since, as previously shown, mortality operated most forcibly upon the plus-plus group of workers in the first five years following Altro discharge, thus eliminating the more sickly, the more resistant survivors in the second and third five-year period spent proportionately less time "curing." But even in these later periods the plus-plus group of workers never reached the low level of sick years of either the minus-minus or the plus-minus group. These data on tuberculous "sick years" post-Altro for

different classes of workers represent an important and realistic measure of the net effect of recurrence of illness.

It will be recalled that 85 per cent of all Altro workers were either in the plus-minus or minus-minus sputum group. For these workers, who constituted such a great majority, the percentage of "well" years in each of these three five-year periods following Altro discharge did not fall below 86 per cent and, in one group, it was as high as 93 per cent. Thus, "well" years during which Altro workers were productive members of the community made up by far the greatest part of their post-Altro life.

#### RECORD OF GRADUATES

Thus far data have been presented concerning all workers admitted to the workshop regardless of whether they had completed the course of work therapy. This final presentation concerns those workers who had successfully reached full work tolerance and had been graduated. They constituted 552 workers or 58 per cent of the total. The proportion of workers who had graduated increased in the last ten years of the study—slightly over two-thirds of the patients admitted being graduated. This increase was in large measure due to a larger proportion of workers with far-advanced disease who had been graduated compared with the earlier period. Three out of five such workers admitted in the period 1930-1939 had been graduated and only one out of four in the early period. In fact, the proportion of workers with far-advanced disease who had graduated during the last ten years was greater than that of workers with minimal and moderately-advanced disease during the first fifteen years of the workshop's experience and in numbers had far exceeded them.

The median stay at the workshop for all graduates was 20.2 months. In the earlier period it was 24.3 months, whereas later it was 19.3 months. This reduction in the median length of the course was largely the result of the reduction in the length of stay found

necessary for workers with advanced disease. Thus, for the period 1930-1939, the length of the course for workers with far-advanced disease was only five months longer than that of workers with minimal disease. Nor was there any significant relationship between the length of stay at the sanatorium preceding admission to the workshop and the length of the work-therapy course.

Comparatively few workers in the recent period required a course of three or more years, such workers accounting for less than 4 per cent of the graduates in the later period. Thirty per cent of graduates had remained at the workshop three or more years in the earlier period.

The mortality and recurrence rates of graduates were extremely satisfactory. Since there was no significant difference in these rates for the workers in the various stages of disease, the data are given for the entire group in Table 7. At the end of five years following graduation from the workshop, 97.8 per cent had survived. This percentage surviving is equal to the expected survival among the general population of like age distribution.<sup>2</sup>

Recurrences were experienced by 13.8 per cent of these workers during the first five years following graduation, an average annual recurrence rate of 3 per 100 compared with 6.6 per 100 for the entire group of workers. The proportion of time spent in "curing" was only 5 per cent for the first five years following graduation.

<sup>2</sup> Computation based upon life table of white males in the United States, 1929-1931. Dublin, Louis I. and Lotka, Alfred J.: *LENGTH OF LIFE*. New York, Ronald Press, 1936, p. 14.

Table 7. Recurrence of illness from tuberculosis and per cent surviving post-Altro for 551 patients who achieved full work tolerance and were graduated.<sup>1</sup>

Years After Discharge	Per Cent With No Recurrence of Illness During Past and Specified Years	Per Cent Surviving Through Past and Specified Years
1	99.81	99.81
2	96.33	99.21
3	91.40	98.77
4	87.78	97.83
5	86.22	97.83

<sup>1</sup> Data include all graduates admitted to Altro, 1915-1939. All stages of disease are combined.

These data demonstrate that workers who achieve full work tolerance at the workshop and are graduated into general industry have a laudable record of health during their post-Altro employment.

#### DISCUSSION AND CONCLUSIONS

With such results, it is suitable to evaluate the position that the sheltered workshop should have in the general scheme of the rehabilitation of the tuberculous. The purpose of the workshop is to "condition" patients who, on discharge from the sanatorium, are not ready to do a full day's work. From the medical standpoint, the moderately-advanced and far-advanced successfully treated patients generally need this type of care most. It is not the purpose of the workshop to choose those ex-patients with whom the best end results will be obtained but rather to employ those who without such "hardening" would run great risks of recurrence of their disease.

From the occupational aspect, those needing the sheltered workshop include part-time workers who have had a trade before becoming ill and could return to such a trade if their physical condition would allow it. Where workers have been employed previous to their illness on a job which is no longer suitable to their physical and mental condition, vocational retraining must be undertaken, but not infrequently such training has to be postponed until the worker is hardened so that the end of the training period shall coincide with his achieving full work tolerance for his new job. In addition, there are students and others who have never been employed before their illness. For such persons too, the retraining is often postponed until the physical condition will allow it.

Obviously, not all patients discharged from the sanatorium with a satisfactory clinical status require a sheltered workshop regimen. A large proportion of patients favorably situated, economically and occupationally, return to their work part time or full time under

the supervision of their private physician and make eminently successful post-sanatorium adjustments.

Others with *full-time* work tolerance at sanatorium discharge require vocational training and are referred to the agencies engaged in such work. Still others with *part-time* work tolerance at sanatorium discharge need a short period of part-time work as well as vocational training and for these, the training course may act as the necessary hardening regimen. Many female patients discharged from sanatoria take up their household duties part time or full time and reach a satisfactory adjustment through this means.

Altro, while it is a garment factory, does not undertake to train its people to become garment workers. Some of them do become garment workers after graduation but retraining is not the purpose of a sheltered workshop. Of course it would be extremely useful if, during this period of "conditioning," the patient could also be retrained for a new job when the old one is unsuitable or if he could be given the opportunity of sharpening his old skills when his old job is suitable. To add these two latter functions to the one of "hardening" would necessitate the establishment of an extremely diversified shop since there are a multitude of occupations from which the workers originally come and many more for which they may later be trained. Such a workshop would be economically unsound and its primary aim—the physical and psychological rehabilitation of the worker with questionable prognosis—would be diffused by the added stress of a retraining program in the workshop.

The advantages of establishing sheltered workshops in the cities are many. The ex-patients and their families are generally city dwellers, since tuberculosis is more commonly an urban disease. Too, the families are loathe to migrate since frequently that would mean a loss of educational and other facilities to which they are accustomed, usually found in cities and not so well developed in rural areas.

Set up in the cities, such workshops can serve a considerable tu-

berculous population. Furthermore, they are then close to the industrial and market centers where their supplies are bought and their products sold.

Another, although secondary, function of the workshop may be mentioned. It has been the policy at Altro to employ workers in the permanently sheltered category up to approximately 10 per cent of the roster. Medically, such patients have been called the "good chronic" cases, patients who have stabilized lesions evident on the x-ray film but who have not been rid of their positive sputum. If properly chosen, some of these patients, too, can be expected to achieve full tolerance and self support under the non-competitive conditions maintained at a sheltered workshop.

The problem here is one of very careful choice of patients. Such patients are similar to the ones that populate the Papworth and Preston Hall Colonies in England. The English experience, as well as the Altro experience, shows that it is not necessary permanently to institutionalize such patients and take up beds needed for the persistent influx of fresh cases. Nor are these chronic cases contributing to the general social good if they are sent home and relegated to complete economic dependency upon the community resources. Colonies and, to some extent, sheltered workshops, can put these substandard people to work earning part if not all of their livelihood, thus, in part, relieving the community of their support. And the workers enjoy a meaningful life.

So much for the sheltered workshop. Now how can industry function in the scheme?

In the first place, employers must recognize that workers who have old, arrested, clinically non-significant tuberculous scars in their lungs present almost as little risk as the non-tuberculous workers. In some instances, old experienced key workers have been discharged following the disclosure of such lung scars by plant x-ray surveys. This practice, we are all agreed, is unsound medically and economically wasteful.

Second, employees who have fallen ill with tuberculosis and are successfully treated should be returned to their old jobs under medical supervision when those jobs are suitable and when medical opinion finds the employee capable of full-time work. Most employers do this. Such a practice could wisely be made universal. Third, if a tuberculous employee is unable to work full time after successful sanatorium treatment, he should be allowed to work at the plant part time. Here especially adequate medical supervision is essential. Where the plants are small and such medical care is not feasible, many plants can pool their resources and perhaps with the aid of local, state, federal, or private health facilities, establish adequate safeguards for these part-time and full-time workers. Work unsupervised is worse than no work at all. Obviously part-time workers are economically not self-supporting. In England today there are proposals that these part-time workers have additional subsidies through a government grant to make up for their needs until such time as they become wholly self-supporting.

Employers should not be asked to re-employ ex-patients with positive sputum and quiescent disease—the “good chronic” case—since the uncertainty of prognosis in these workers is great. The public health considerations are also against such a procedure.

Those planning the rehabilitation of the tuberculous are faced with two major problems at the present time. First there is the immediate problem of contributing to the manning of the war industries. As has been said, the successfully treated part-time and full-time tuberculous worker can be integrated into the scheme with great benefit to the nation and to the worker himself. A risk is present but if workers are chosen on a sound medical basis, the risk is not great and is worth taking particularly in the present emergency. Second, plans must be made for the future tuberculous service men and civilian war workers. The expansion of the facilities for training and placement of tuberculous workers is necessary. In addition, the establishment of workshops for industrial con-

valescence and perhaps colonies for the "good chronic" patients is called for. The experience at Altro can be suggestive to those engaged in such planning. It is believed that the Altro results have shown that the sheltered workshop has a definite and useful place in the scheme for the rehabilitation of the tuberculous.

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# THE VITAMIN A, VITAMIN B<sub>1</sub> (THIAMIN), VITAMIN C (ASCORBIC ACID) AND RIBO- FLAVIN CONTENT OF COMMON FOODS

A SUMMARY OF "REPRESENTATIVE" VALUES

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**D**URING the past two years there has been a decided increase in the attention given by various investigators to the subject of the vitamin content of foods. This is due in part to the interest in nutrition aroused by our National emergency but more largely to the new methods of vitamin assay now being developed. These newer techniques concern practically all of the known vitamins and are rapidly gaining favor because of the ease and rapidity with which results may be obtained with them. While there may be questions in some cases as to the degree of specificity under certain conditions, the interest shown by the numerous investigators working with them warrants confidence that most of these questions will be answered by improvements in procedure as the subject develops.

In a paper published in the October, 1940, issue of the *Quarterly*<sup>2</sup> a table of values for the vitamin A, vitamin B<sub>1</sub>, vitamin C, and riboflavin content of foods was presented. The values offered were selected by first making a compilation of all published data and then from a consideration of all of the data on a food, assigning a single value for each vitamin which was considered as "representative." This designation was intended to make clear that the values presented were not averages but were selected according to the best judgment of the author as being most generally applicable.

A sincere effort was made to have the values for similar food

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<sup>2</sup> Munsell, Hazel E.: Vitamins and Their Occurrence in Foods. The Milbank Memorial Fund *Quarterly*, October, 1940, xviii, No. 4, pp. 311-344.

items consistent with each other. This required giving particular attention to comparisons made by a single investigator and in some cases applying the relations brought out by such data in assessing more numerous data presented by other investigators.

In cases where values were given for parts of a food item as well as for the whole, care was taken to have the sum total of the values for the various parts approximate, at least, the value for the whole food. An example may be found in the vitamin A values for whole milk, skim milk, and butter. There may be certain arguments against this procedure but in the light of the variations in values encountered for most food items it seemed the most reasonable.

Since July, 1940, when the compilation which served as a basis of the table of vitamin values described above was completed a large number of reports have appeared in the published literature giving information on the vitamin content of foods. In many cases information is now available where there had been none before and in others more reliable data have been presented which can be used as the basis of values to replace uncertain estimates made previously.

In accordance with these developments a complete revision of the table of vitamin values published in 1940 has been made and is offered here. The compilation of data for this revision included published data to July, 1942. The same policy was followed in selecting the values as was followed in preparing the first table. The major change involves expression of values for vitamin B<sub>1</sub>, vitamin C, and riboflavin in terms of weight rather than in terms of units. If expression by units is desired the values by weight may be converted by the appropriate factor.\*

It seems advisable to direct attention to the fact that in selecting these "representative" values no discrimination was made against data in the compilation on the basis of the method of assay used in the determination although this was considered in the evaluation.

\*One mg. thiamin equals 333 International units; 1 mg. ascorbic acid equals 20 International units (1 International unit equals 1 U.S.P. unit).

This policy was followed from the viewpoint that it is a fallacy to discount data absolutely because they were determined by methods now outmoded when careful consideration in many cases showed that data obtained by these "outmoded" methods were more consistent than data obtained by a more recently developed method which has not been perfected to the point of strict reliability.

The values suggested here, as in the first table, apply to the edible portion of the fresh food. No attempt whatever has been made to give summarizing statements for treated foods. Whereas, information on the effect of various treatments on the nutritive value of foods, especially vitamin content, is much to be desired and whereas programs of research have recently been designed for obtaining such information it may be some time before this is available in a form for practical application.

The Vitamin A; Vitamin B<sub>1</sub>, or Thiamin; Vitamin C, or Ascorbic Acid; and Riboflavin Content of Common Foods.

	VITAMIN A	THIAMIN	ASCORBIC ACID	RIBOFLAVIN
	Values per 100 Grams Edible Portion			
	I.U.	Micrograms	Milligrams	Micrograms
Alfalfa Leaf Meal, Dried	8,000			1,500
Almond	75	225		300
Apple	75	35	.5-20 Av. 6	10
Apricot, Fresh	4,000	45	7	
Dried	6,000	90	2	100
Artichoke, Globe ( <i>Cynara Scolymus</i> )	200	75	9	30
Artichoke, Jerusalem ( <i>Helianthus Tuberosus</i> )		60	7	
Asparagus, Green	900	180	40	120
Bleached	0-50	180	30	
Avocado	125	90	10	90
Banana	350	50	10	75
Barley	0	500	0	120
Beans, Snap				
Green	1,000	75	25	110
Wax	300	75	25	100
Beans, Shelled, Fresh				
Lima	300	300	30	175
Runner	500	300	25	
Soybean	200	500	40	300
Beans, Shelled, Dried				
Lima	100	525	0	750
Navy	0	510	0	325

	VITAMIN A	THIAMIN	ASCORBIC ACID	RIBOFLAVIN
	Values per 100 Grams Edible Portion			
	I.U.	Micrograms	Milligrams	Micrograms
Beans, Shelled, Dried (Continued)				
Red Kidney		450	0	
Soybean	100	1,200	0	750
Beef, Lean	20	125	0	225
Beet	0	30	15	50
Beet Tops	15,000		50	300
Blackberry	75	30	7	
Black-Eyed Peas—see Cowpeas				
Blueberry	50	30	Av. 10	
Brazil Nut	10	500		
Bread, White 6% Milk Solids		65	0	130
Whole Wheat 6% Milk Solids		210	0	180
Rye		210	0	
Broccoli, Entire Plant	9,000	111	65	225
Flower	3,000	135	65	240
Leaf	12,000	135	70	450
Stem	1,000	75		
Brussel Sprouts	500	150	65	
Buckwheat		450	0	
Butter, Average	2,700		0	
From Cows on Dry Feed	2,000		0	
From Cows on Green Feed	5,000		0	
Cabbage, Head,				
Young, Partly Green	150	30	60	50
Mature, Bleached	0	30	60	25
Red			60	
Chinese	9,000	30	45	45
Cantaloupe	1,000	50	30	60
Carrot	10,000	60	10	60
Cauliflower	50	150	75	105
Celery Stalks				
Green	1,000	30	5	100
Bleached (Hearts)	10	30	5	35
Chard	10,000		35	125
Cheese				
Cheddar	1,500	24	0	550
Cottage	175		0	280
Cream	2,000			
Cherry	15-800 Av. 150	45	8	
Chicken, Muscle				
Dark		150		260
Light		90		70
Clam	200	25		
Cod Fish	0	90	0	
Cod-Liver Oil	*	0	0	
Collards	12,000	80	60	300
Corn, Sweet				
White	0-50	135	10	
Yellow	600	135	10	60

\* Use value given on the container.

	VITAMIN A	THIAMIN	ASCORBIC ACID	RIBOFLAVIN
	Values per 100 Grams Edible Portion			
	I.U.	Micrograms	Milligrams	Micrograms
Corn, Dried				
White	0	450	0	130
Yellow (Whole Grain Cornmeal)	750	450	0	130
Corn Oil, Refined	0	0	0	0
Cottonseed Oil, Refined	0	0	0	0
Cowpea, Fresh			5	
Dried	30	500	0	300
Cranberry	50		12	0
Cream, 20 Per Cent	650	35		
Cucumber	20	30	9	25
Currant, Black	400	30	150	
Red		45	45	
Dandelion	12,000		100	
Dates, Cured	300	75	0	45
Dock Leaves	14,000			
Egg, Whole, Average	1,000	150	0	250
White	0	0	0	230
Yolk	2,800	420	0	285
Eggplant	100	45	10	30
Endive, Escarole	10,000	50	15	200
French		75	20	60
Fig, Fresh	10	60	2	5
Dried	60	60	0	45
Flour, White, Patent	0	75	0	40
Whole Wheat		450		100
Garden Cress		90		
Gooseberry			25	
Grape	0	50	4	15
Grape Juice			2	
Grapefruit	0	40	43	
Grapefruit Juice	0	45	45	12
Canned	0	45	40	
Guava	200	45	75	10
Haddock	0	15	0	
Halibut		90		
Hazelnut	100	400		
Heart				
Beef	200	600		900
Lamb	trace	600		
Pork		600		900
Honey	0	0	0	0
Horseradish			100	
Huckleberry			30	
Kale	16,000	150	100	400
Kidney				
Beef or Veal	1,000	250		2,100
Lamb	1,000	300		2,000
Pork		500		2,100
Kohlrabi		50	60	
Lamb Muscle, Lean	trace	200	0	250
Lard	5	0		

	VITAMIN A	THIAMIN	ASCORBIC ACID	RIBOFLAVIN
	Values per 100 Grams Edible Portion			
	I.U.	Micrograms	Milligrams	Micrograms
Leek	1,000	80	15	
Lemon Juice	0	30	45	0
Lentils, Dried	50	500	0	315
Lettuce				
Green	5,000	75	15	150
Bleached, Head	100	75	15	45
Romaine or Cos	1,000			100
Lime Juice		30	37	
Liver, Beef	30,000	400	fresh 37	3,000
Calf	27,000	400	fresh 32	3,300
Chicken	24,000	400	fresh 35	2,500
Lamb	27,000	400	fresh 37	3,300
Pig	27,000	425	fresh 27	2,700
Mango	1,000	60	25	50
Milk				
Whole, Fresh, Average Market	120	42	(fresh 2.2 pasteurized 1.3)	195
From Cows on Dry Feed	60	42	1.5	160
From Cows on Pasture	180	42	1.5	210
Whole Dried, Average	960	250	0	1,500
From Cows on Dry Feed	480		0	
From Cows on Pasture	1,440		0	
Skim	10	45	0	200
Skim, Dried	100	320	0	1,600
**Milk, Whole, Evaporated	400	53	1.2	390
Molasses	0	0	0	
Mushrooms	0	60	1	5
Mustard Greens	10,000	100	120	
Oats, Rolled or Oatmeal	0	540	0	100
Okra	2,000	120	20	
Olive, Canned, Green	200		0	
Ripe	125	6	0	0
Olive Oil, Refined	0			
Onion, Green	5,000		30	
Mature	0	30	15	50
Orange Juice	150	70	45	15
Oyster	200	300		
Papaya	2,500	50	45	180
Parsley	18,000		100	
Parsnip	0	80	22	
Pea, Green, Fresh	1,000	400	25	200
Dried	750	525	0	300
Peach				
White	100	40	10	
Yellow	2,000	40	10	60
Yellow, Dried	3,000		0	
Peanut, Jumbo	0	900		500
Roasted	0	200	0	
Spanish	0	900		500
Roasted		200		
Pear	30	40	7	20

\*\*Values should be considered tentative until more reliable values are available.

	VITAMIN A	THIAMIN	ASCORBIC ACID	RIBOFLAVIN
	Values per 100 Grams Edible Portion			
	I.U.	Micrograms	Milligrams	Micrograms
Pecan	300	500		300
Pepper, Green	3,000	30	125	50
Red	2,000	30	150	
Pineapple, Whole	150	50	20	5
Juice, Fresh	125	65	25	
Juice, Canned	100	50	20	
Plum	350	50	7	45
Pork Muscle, Lean	0	1,200		225
Potato, White, Average	30	100	10	40
New			15	
Old			9	
Prune, Fresh	1,500	50		
Dried	2,500	125	0.5	50
Pumpkin	2,000	45	5	45
Quince			8	
Radish	25	60	25	30
Raisin, Seedless	0	100	0	
Raspberry, Red	150	30	25	
Rhubarb	100	15	20	
Rice, Brown	0	225	0	80
Polished	0	30	0	0
Roe	2,000	1,000	5	100
Rutabaga, White	0	70	45	
Yellow	25	70	45	
Rye	0	500	0	140
Salmon, Canned				
Chum	30	30		
Chinook	750	30		
Pink	100	30		
Red	325	30	0	225
Sardine	150	50		
Soybean— <del>see</del> Bean				
Spinach	18,000	100	50	400
Squash, Summer	750	45		50
Winter	4,000	45	5	50
Strawberry	50	25	50	
Sweet Potato	3,500	90	20	75
Tangerine		70	35	20
Tomato, Mature Green	800	70	22	45
Ripe	1,000	75	22	45
Tomato Juice, Fresh	1,000	75	22	45
Commercial Canned			8-29 Av. 18	
Turnip, White	0	30	30	30
Yellow	20	30	30	35
Turnip, Greens	18,000	100	100	350
Walnuts, Black	70	330	0	
English	50	450	0	
Watercress	4,000	100	75	270
Watermelon	50	30	7	15
Wheat, Hard	0	525	0	100
Soft	0	350	0	100